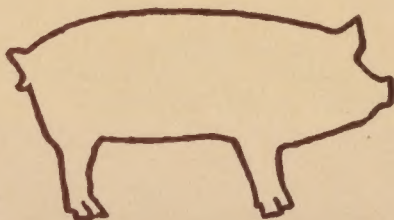
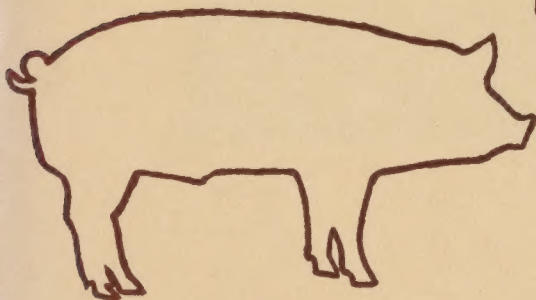
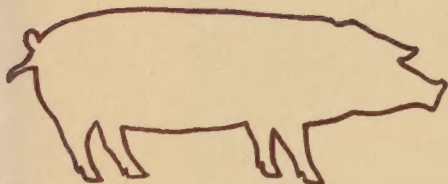
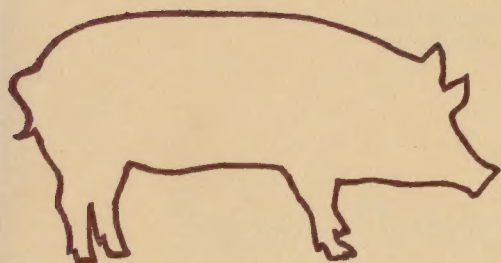


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SWINE PRODUCTION IN ALBERTA

Dept. of Animal Science
Faculty of Agriculture

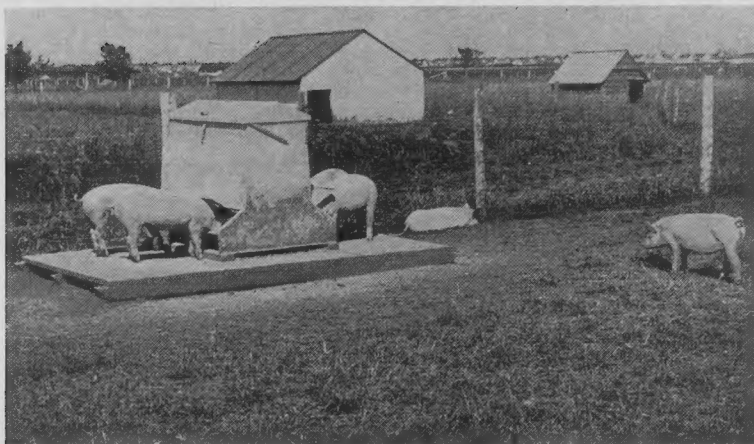
UNIVERSITY
OF
ALBERTA



**UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURE**

Swine Production in Alberta

BY
DEPARTMENT OF ANIMAL SCIENCE



Distributed by
Department of Extension, University of Alberta
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BEAR IN MIND

1. Pigs will produce more meat from 100 pounds of farm-grown feed than any other farm animal.
2. Pigs will eat and grow and finish on a greater variety of feeds than any other animal on the farm.
3. Pigs multiply rapidly so that the money invested in a sow is returned quickly.
4. Pigs constitute a reliable source of revenue and provide the farm table with a high-class meat product.
5. Approximately 10,000,000 hogs, or one-fifth of Canada's total production, were marketed in Alberta during the 10 years 1949-1958.
6. Success in pig raising depends upon the use of breeding stock of the right kind, together with good feeding and management methods.
7. Alberta-grown grains—oats, barley and wheat—when properly supplemented will produce as good bacon hogs as can be produced anywhere in the world.
8. Pigs should be kept year in and year out. Over a period of years they will provide a profitable outlet for farm-grown grains and farm byproducts.
9. Control of disease and parasites is essential to success in pig raising. Diseased pigs and those infested with worms are a liability rather than an asset.

The first edition of Bulletin 22, Swine Production in Alberta, was published in 1932. Popular demand for the bulletin dictated the preparation of revised up-to-date editions in 1934, 1937, 1939, 1941, 1945, 1948, 1952, and 1956. Prior to the release of this, the tenth edition, some 49,000 copies were distributed to farmers and others interested in the swine industry.

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Swine Production In Alberta

BY

J. P. BOWLAND, R. T. BERG AND L. W. McELROY

Department of Animal Science

INTRODUCTION

After approximately sixty years of agricultural evolution in this Province, annual revenue from pig sales has risen from a few thousand dollars to many millions and pork products processed in Alberta packing plants find their way to the markets of the world. Alberta requires approximately 425,000 hogs for her own use. Average annual production over the past 5 years has been almost 1,600,000 hogs so that more than 70% of the pork produced has been sold outside the Province.

The pig is second-to-none as a converter of high as well as low grade grains into palatable, nutritious meat. In times of high grain prices the value of the pig in the farm economy is often not appreciated, but when prices decline, when quotas limit the amount of grain which can be marketed, or when grades are lowered as a result of frost or other damage the value of this class of livestock is brought markedly to the fore. As will be indicated in the discussion which follows, the Alberta farmer who has kept pigs year in and year out, either as a sideline or as a major part of his farm enterprise, has little reason to be discouraged with the results in terms of financial returns.

The estimated value of the 7,963,929 Alberta hog carcasses graded, plus that of a few thousand hogs exported alive during the 5-year period 1954-58 was \$325,213,372 or \$65,042,674 annually—a sum which is significant in relation to farm buying power and the economy of the Province.

It is of interest to note Alberta's relative position in the matter of swine production. According to the most recent statistics available, the various provinces rank as follows:

TABLE I.—NUMBER CARCASSES GRADED AND ESTIMATED VALUE OF TOTAL MARKETINGS INCLUDING SWINE EXPORTED ALIVE, 1958.

Province	Number	Value \$
Ontario	2,183,578	100,874,802
Alberta	1,812,186	74,618,843
Quebec	1,128,989	51,301,487
Saskatchewan	704,201	27,976,013
Manitoba	464,420	19,427,191
New Brunswick, Nova Scotia, Prince Edward Island	133,904	6,102,910
British Columbia	31,570	1,347,048
Total	6,458,848	281,648,294

Since 1953 Alberta has stood second among the provinces in number and value of swine sold. Her position is likely to be strengthened in the years that lie ahead. Conditions are favorable for swine raising in the Province from the stand-point of volume, quality and continuity of feed supply. It is important that swine raisers realize Alberta's status in this field because it is clear that they have an important responsibility as contributors to the Canadian pork supply for home or export consumption. The number of hogs originating in this Province materially affects the quality of Canadian pork products and it therefore behooves Alberta producers to pay careful attention to improvement in quality. As is indicated on page 13 there is a good deal of room for improvement.

IS HOG RAISING IN ALBERTA PROFITABLE?

It is appropriate, early in the discussion of swine production in Alberta, to consider whether the pig business is on a sound economic footing. Our interest in what will follow, and in fact our interest in pig raising generally, in terms of a long time program, may hinge on this point. A review of what has taken place in the years which have passed will prove valuable in this connection and may point the way to what may be expected to happen in the years that lie ahead.

In considering the economic status of the hog business, it seems necessary to attempt to relate the cost of production to the selling price over a period of years and thereby show the number of years when hogs have been good property and the number when they could be considered a liability.

We have records for the years 1918 to 1958 inclusive. This span of 41 years includes periods of world war, post war recovery, depression and prosperity. It thus covers a sufficient variety of conditions to yield a result which should provide a guide in laying plans in connection with a swine raising enterprise.

Two main factors enter into the cost of producing hogs: (a) overhead cost, and (b) feed cost. At the University of Alberta, in an attempt to estimate costs of production, we have taken 4 sows as a farm unit and have calculated on the basis of 7 pigs raised per litter with all sows farrowing in the spring and 2 farrowing again in the fall, or, in other words, 6 litters of 7 pigs or 42 pigs marketed during the year. Including a feed grinding charge of 15 to 20 cents per cwt., interest at 6% on money invested in breeding stock, buildings and equipment, and on the value of the land used for pasture, allowing for 5% and 10% depreciation on buildings and equipment respectively, charging pasture on the basis of cost of seeding, and providing for a \$3.00 to \$5.00 labor return per pig, as well as compensation for delivery of pigs

to market, we estimated an *overhead* cost of hog production. This figure has varied from time to time depending upon depreciation in values of breeding stock and other items as well as the labor return. The range has been from a high of \$13.80 per market hog during 1957 and 1958 to a low of \$4.30 per hog during the 1930's.

From the results of numerous experiments with pigs under various conditions, we conclude that 450 lb. of grain or its equivalent should produce 100 lb. of live hog. A 200 lb. hog will require 900 lb. of grain; this will make provision for the feed for the sow during the pregnancy and suckling period. Some may feel that this figure should be higher but the figure of 900 lb. will apply where the system of feeding and management is reasonably good. On farms where proper supplements are not used the figure will run much higher (see pages 48 and 49).

If the yearly average cash price, in cents per pound, of a mixture of equal weights of oats and barley, multiplied by 450, is taken as the *feed cost*, and the *overhead* figure is added to this, we arrive at the yearly average cost of *producing hogs*. When this figure is related to the average yearly price of the basic grade of hogs, we can study the cost of production in relation to selling price.

Table II sets out the average yearly selling prices of hogs on the Edmonton market from 1918 to 1958, together with the average yearly costs of production over the same period. Grain was charged at Edmonton cash grain prices for No. 1 Feed barley and oats. Hog prices were based on the "thick smooth" grade for the years 1922 to 1929, on the "bacon" grade from 1930 to 1940, and on B₁ carcass prices plus premium converted to live hog prices from 1941 to 1958.

Table II shows:

(1) The average Edmonton price of the basic grade of hogs over the 41-year period was \$13.55 per 100 lb. live weight.

(2) The average cost of producing 100 lb. live weight of hog was \$9.64.

(3) During this 41-year period pigs paid all overhead costs as outlined above and provided a margin of \$3.72 per 100 lb. or approximately \$7.40 per hog between the cost of production and selling price.

(4) There were only two years, 1924 and 1932, in which the average cost of production for the year exceeded the selling price. This condition existed for all 12 months of 1924 and for 9 months in 1932. In the remaining 39 years there were only occasional months in which the cost of production exceeded the average selling price.

(5) An alternative method of estimating the profits realized from hogs is to calculate the return obtained for a bushel of grain

marketed through the feedlot route and compare this with the cash or Wheat Board payment for grain. This estimate has been made year by year on a "net" basis; i.e. after deducting from the gross returns an overhead charge of from \$4.30 to \$13.80 per hog. The average Edmonton cash price (since 1949 the total Wheat Board payment) for No. 1 Feed barley over the 41-year period has been 63 cents per bushel, whereas this grain was marketed through hogs at \$1.04 per bushel. *The barley was increased in value 65% by marketing as pork instead of as grain.*

TABLE II.—HOGS RETURN A PROFIT

Year	Selling Price of Basic Grade Hogs	Cost of Production	Difference
Basis 100 lb. Live Weight			
1918	\$19.31	\$13.61	\$ 5.70
1919	20.53	12.79	7.74
1920	18.68	14.95	3.73
1921	12.11	8.34	3.77
1922	10.33	7.79	2.54
1923	8.39	7.33	1.06
1924	7.45	8.50	—1.05
1925	11.58	9.22	2.36
1926	12.48	8.10	4.38
1927	10.08	9.66	.42
1928	9.34	9.26	.08
1929	11.20	9.00	2.20
1930	10.66	6.38	4.28
1931	6.01	3.94	2.07
1932	3.45	3.92	— .47
1933	4.80	4.49	.31
1934	7.45	5.62	1.83
1935	7.72	5.45	2.27
1936	7.71	5.42	2.29
1937	8.15	7.08	1.07
1938	8.88	5.74	3.14
1939	8.33	4.63	3.70
1940	7.81	5.51	2.30
1941	8.86	6.32	2.54
1942	10.66	8.35	2.31
1943	11.70	9.30	2.40
1944	12.86	10.23	2.63
1945	13.16	10.29	2.87
1946	13.88	10.47	3.41
1947	15.54	11.51	4.03
1948	21.75	12.34	9.41
1949	22.95	13.79	9.16
1950	22.07	14.66	7.41
1951	25.36	14.30	11.06
1952	19.06	13.81	5.25
1953	20.90	12.81	8.09
1954	21.52	13.13	8.39
1955	16.47	13.44	3.03
1956	17.72	14.19	3.53
1957	21.50	14.77	6.73
1958	19.13	14.77	4.36
Average	13.55	9.64	3.72
Av. Edmonton Price No. 1 Feed barley (1918-58):			
Marketed through hogs (net)			\$1.04
Marketed direct			0.63
Difference			0.41

The swine business in Alberta has been on a sound economic footing. No business can be judged on one year's operation, and there are few enterprises that do not show occasional "loss" years. The Alberta farmer who makes pig raising a part of his regular farming program over a period of years will find the business

profitable rather than unprofitable. The individual who attempts to run pigs on the "in and out" plan is very apt to find the results disappointing as he is likely to be in when he should be out and out when he should be in. The "in and out" policy disturbs that marketing situation and gives rise to a condition of instability that is detrimental to regular producers. The man who keeps pigs regularly, slightly raising or lowering the number of brood sows as changes in the market may be foreseen, is the one who contributes to permanency and quality in the pig business.

Size of Enterprise and Efficiency

Data from the 1956 census show that pigs were being raised on 45,000 or 57% of the 79,000 farms in Alberta. As of June 1 there were from 1 to 32 pigs on 33,000 or 73% of the 45,000 'pig' farms. This indicates that the majority of the pigs produced in Alberta come from 1 to 4-sow units. Detailed statistics are not available but there is evidence that in recent years a growing number of producers are proceeding in the direction of more specialization in swine production in larger units. There is no rule that will fit all conditions with respect to what constitutes a unit of sufficient size for efficient and profitable swine production. But there is plenty of evidence that improvements in breeding, feeding and management are more likely to occur in large units which constitute a major source of income than in small ones in which swine contribute a very minor fraction to farm sales and thus tend to receive a correspondingly small amount of attention.

In 1956 only 2,251 or 5% of the hog farms in Alberta reported an inventory of 78 or more pigs on June 1. The number of 10-sow and over units may be expected to increase in the future.

Value of Efficient Feeding

When the feed requirement is lowered as a result of efficient feeding, the net price received for grain is increased while a lower price is obtained when the amount of feed required is high.

As a guide to the net returns which may be expected for grains when hogs sell at different prices, and in order to indicate the influence on returns of the amount of feed required to produce 100 lb. of live weight gain, Table III is submitted. An overhead charge of \$5.00 per 100 lb. of live hog was used in calculating the net returns shown in this table.

Monthly Variations in Marketing

A situation which affects the business of processing hogs and presents a problem in connection with continuity of supply of pork products is the variation in volume of hogs marketed from month to month. As a general rule, a much larger number of hogs

TABLE III.—NET RETURNS FOR GRAIN WHEN MARKETED THROUGH HOGS

	\$	\$	\$	\$
Market price of hogs—per 100 lb. live weight	12.00	16.00	20.00	24.00
Market price of hogs—per 100 lb. dressed weight	16.00	21.35	26.65	32.00
Net returns for grain allowing 400 lb. of grain or its equivalent for 100 lb. live weight gain:				
Net value per bushel grain fed:				
Wheat	1.05	1.65	2.25	2.85
Oats	.60	.94	1.28	1.62
Barley	.84	1.32	1.80	2.28
Net returns for grain allowing 450 lb. of grain or its equivalent for 100 lb. live weight gain:				
Net value per bushel grain fed:				
Wheat	.93	1.47	2.00	2.53
Oats	.53	.83	1.13	1.44
Barley	.75	1.17	1.60	2.03
Net returns for grain allowing 500 lb. of grain or its equivalent for 100 lb. live weight gain:				
Net value per bushel grain fed:				
Wheat	.84	1.32	1.80	2.28
Oats	.48	.75	1.02	1.29
Barley	.67	1.06	1.44	1.82

is marketed during the fall and early winter months than during the summer months. Regularity of supplies is very desirable, and anything that can be done in connection with arranging for farrowing fairly steadily throughout the year will contribute to an even flow of hogs to the packing plants. There has been considerable improvement in Alberta in this respect during recent years. Better farrowing quarters, treatment for anemia and inside feeding have all contributed to this betterment in our performance. We must continue in our efforts to still further improve our position in this respect. The only practical way to compensate for monthly fluctuations in slaughterings is to put pork in cold storage and this will lead to a lowering of the net returns.

Winter Pigs Pay Their Way

During the period from 1922 to 1959 approximately 6,500 pigs have been farrowed during the fall, and grown and finished during the winter months, at the University of Alberta. The majority of these pigs have been used in experiments regarding the feeding and management of pigs finished during the winter months. The economics of the business has been carefully checked. Winter pigs have returned a satisfactory profit. The margin between cost of production and selling price has varied year by year depending upon the relationship between hog and grain prices, but over a period of years the second litter has proven profitable.

It has been demonstrated clearly in our winter experiments, however, that the feeding of protein, mineral and vitamin supplements is a necessity if economical gains are to be made. The large number of inquiries which we receive each year during the late

winter months, regarding slow gains and "cripling" among winter pigs, indicate that more attention must be paid to better balanced rations. (See pages 36 to 49.)

QUALITY AND MARKET OUTLETS

A matter of great concern in connection with the production of any class of livestock is that of available markets for the product.

The importance of the domestic market is illustrated by the fact that of the 29,000,000 Canadian hogs graded in the years 1954-58 the product of 26,600,000, or approximately 92%, has been consumed in Canada.

The Canadian consumer prefers lean cuts of pork and bacon. Possibilities in the way of export markets are at present limited but there is nothing to indicate that satisfactory export outlets can be developed on anything other than a quality basis.

Packers can, to a degree at least, make a lean carcass from a fat one by trimming off surface fat, but fat is, and appears destined to continue to be, a drug on the market. Processed lard frequently sells for less per pound than it cost as carcass fat. In the final analysis the consumer makes up the difference by paying more for table pork.

In periods of high income and high prices for competitive meats Alberta swine producers may be able to enjoy the luxury of producing fat hogs, but under less favorable conditions it seems evident that they must concentrate on the production of hogs that can be processed into attractive bacon and cuts of pork with a minimum of waste in the form of fat trimmings. Good breeding stock, balanced rations and marketing at desirable weights are three important factors in the production of hogs that meet this requirement.

From Table IV it is evident that Alberta has never occupied an enviable position with respect to the percentage of top grade carcasses marketed. In recent years the percentage of grade A carcasses produced has not simply been well below the average for Canada, but lower than that for any other province.

TABLE IV.—TOTAL SWINE GRADED IN CANADA AND IN ALBERTA WITH PERCENTAGES IN TOP GRADE

	No. Graded		Selects 1923-40	
			Grade A 1941-....	1941-....
	Canada	Alberta	Canada	Alberta
			%	%
1923-32 average	2,725,763	642,728	15.8	5.4
1933-42 average	4,182,084	1,239,599	25.6	24.4
1943-52 average	5,665,624	1,504,696	30.4	24.0
1953	5,002,814	1,432,438	27.3	19.9
1954	5,078,715	1,461,770	25.9	18.2
1955	5,916,584	1,685,887	27.1	18.9
1956	5,959,605	1,571,929	28.5	20.2
1957	5,400,239	1,432,157	28.7	20.7
1958	6,458,848	1,812,186	28.7	21.4

BREEDS OF SWINE

Canada has concentrated on the production of high quality bacon carcasses with a high proportion of lean meat relative to fat. Certain breeds are inherently more suitable for the production of a high quality carcass than are others. However, there are good and bad individuals within all of the standard breeds and it therefore behooves the producer to select breeding stock wisely with due consideration to records of performance for economic characteristics as outlined on pages 16 to 23. Brief descriptions of breeds which have proven suitable for the production of bacon-type carcasses in Canada are given in the following section, along with some mention of breeds common in the United States.

Yorkshire

The Yorkshire is the most common breed of swine in Canada. It originated in Yorkshire, England. The Yorkshire is a prolific breed and improved strains give a high quality bacon carcass. It is a white pig desired by the packer but, as are other white breeds, it is susceptible to sunscald. Whether raised pure or in crosses, the Yorkshire provides a good base for a successful, commercial hog production enterprise.

Landrace

The Landrace, a white, flop-eared breed native to the Scandinavian countries, has recently gone through a phase of extreme speculative popularity in Canada. The Landrace compares favorably with the Yorkshire in average merit as is indicated in the results shown in Table V. The breed is available in large numbers and its use in commercial crossbreeding is well established throughout the country. Tests at the University of Alberta in 1958-59 indicate that there is considerable variation in quality potential of purebred Landrace boars as is also true for the other standard breeds (see Table VII, page 30).

TABLE V.—RESULTS OF RECORD OF PERFORMANCE TESTS FOR SWINE IN CANADA 1958

Breed	No. of Litter Groups Tested	Age at Slaughter	Feed/100 lb. Gain basis carcass wt.	Total Carcass Score
Yorkshire	1040	184	446	80
Landrace	37	174	445	84
Lacombe	55	168	443	83
Tamworth	3	178	514	61

Lacombe

The Lacombe hog represents the first venture in the application of genetics and scientific breeding principles to the formation of a new breed of livestock in Canada. It is a flop-eared white pig, similar to the Landrace but of a thicker, heavier boned appearance. It was developed at the Experimental Station, Lacombe, Alberta,

from a foundation of Landrace-Chester (a breed produced at Beltsville, Maryland), Berkshire, and Landrace stock. Its parentage at the present time is about $\frac{1}{2}$ Landrace, $\frac{1}{4}$ Berkshire and $\frac{1}{4}$ Chester White. It was developed with the objective that, in crosses with the Yorkshire, hybrid vigor would result. A mild inbreeding system and rigorous selection, based on complete records of performance, were used in developing the breed.

Females of the Lacombe breed were first released to the public in the fall of 1958. A Lacombe Breed Association was formed in August of 1959. The breed is selectively registered in that minimum performance with regard to growth rate, feed efficiency and carcass quality must be achieved before an animal can be registered.

English Large White

The English Large White has the same ancestral background as the Yorkshire but is sufficiently unrelated to cross reasonably well with that breed. It is reputed to be faster growing, but indications are that it is slightly inferior in carcass merit to the better strains of Yorkshire under Canadian self-feeding systems.

Tamworth

The Tamworth is one of the oldest breeds of pigs and had its origin in England. Although the Tamworth is recognized as a bacon breed, on the average it tends to have poorer carcasses than the three main white breeds mentioned above. The Tamworth is valued for its hardiness and vigor. Crosses with the white breeds at the University of Alberta showed more hybrid vigor in growth and survival than any other combination tested. In the same trials one out of three Tamworth boars used had offspring with carcasses fully equal in quality to any other breeding group under test. The numbers of purebred Tamworth breeders are small and there are very few groups tested under the R.O.P. policy for swine, making it difficult to locate high quality Tamworth boars for commercial production.

Berkshire

The Berkshire breed also originated in England. Canadian breeders have developed strains which can be classified as bacon-type pigs. As a breed it is superior in growth rate to either the Yorkshire or the Tamworth but a tendency to fatness and to some extent shortness may cause the carcass to be graded down. The Berkshire is black which results in lower grades because of color pigment. Crosses with the white breeds produce white, thrifty pigs of more desirable bacon type.

Other Breeds

Such breeds as the Duroc, Chester White, Hampshire and Poland China have been used occasionally in Canada with rather bad results as far as carcass quality and grades are concerned. These so-called lard breeds are fast-growing, which characteristic may encourage their use in spite of carcass grades. It is possible to get growth and efficiency without resorting to the lard breeds. In the U.S. at the present time there is a big swing toward meat type within the above breeds. How successful these programs will be cannot yet be appraised.

New Breeds and Inbred Lines

Several new breeds have recently been formed in the United States. Because these breeds have been inbred they are commonly referred to as inbred lines. Until recently there has been little emphasis on carcass quality. Such breeds as the Minnesota No. 1, No. 2 and No. 3, the Beltsville No. 1 and No. 2, the Maryland No. 1 and the Montana No. 1 are all superior to the old lard breeds in carcass quality while being equal or superior in growth and efficiency. These breeds cannot be recommended as yet since they have not been tested under Canadian conditions.

BREEDING AND SELECTION IN SWINE

Hereditary differences exist between individuals, families and breeds with regard to economically important characteristics of swine. Systems of breeding and selection methods have been devised through which permanent improvements in the efficiency of swine production are possible. Breeding, feeding, management and disease control all work together to make a hog production enterprise efficient. Proper understanding and application of breeding principles will ensure that a producer will be in a much better position to take advantage of advances in feeding, management and disease control covered in other parts of this bulletin.

Kind of Pig Desired

In breeding a better pig, it is necessary to concentrate on the important characteristics which make the pig superior for the job we expect it to do. Emphasis should be placed on those economically important traits which are known to be hereditary. If selection can be based on a minimum number of the most important characteristics, more progress will be made than if many minor points are included. The most important economic factors in hog production are (1) fertility, (2) livability, (3) growth rate, (4) efficiency of feed utilization, and (5) carcass quality. Sows which consistently produce large litters of thrifty pigs which grow rapidly on a min-

imum of feed and give a maximum percentage of top carcasses are desired.

Once having defined the kind of pig which is wanted it is necessary to set up a testing and selection program which will help in picking this kind of pig.

Records

A "HANDY RECORD BOOK FOR SWINE" designed for recording characteristics of economic importance from birth to market is available from the Department of Extension, University of Alberta, Edmonton.

There is no substitute for adequate records as a basis for a sound breeding and selection program. Records will help to identify both pigs which should be multiplied because they are superior and those which should be culled because they are inferior.

The Production and Marketing Branch of the Canada Department of Agriculture maintains a pig testing station at Edmonton in conjunction with their R.O.P. policy. Litter groups of 4 pigs are kept on a standard ration from 50 to 200 lb. liveweight, and pertinent records are obtained relative to growth rate, feed efficiency and carcass merit. Interested persons can obtain details from the Production and Marketing Branch, Canada Department of Agriculture, Edmonton. R.O.P. information can be very useful to a breeder but it should be complementary to, rather than a substitute for, adequate records maintained on pigs kept at home from which breeding stock must ultimately be selected. The following section is designed to give an insight into records which should be acquired at home and used in one's own herd improvement program.

The most important records to keep are (1) identification, (2) birth dates and birth weights, (3) weaning weights, (4) age to market weight or approximately 200 lb., (5) type or conformation score at or near 200 lb., and (6) market grades.

Identification

If information relative to each pig is to be kept it is necessary to permanently identify each animal soon after it is born. Tattoos and ear tags are official systems for identifying registerable pigs and anyone wishing to identify for registration purposes should write to the Canadian National Live Stock Records, Department of Agriculture, Ottawa, for full particulars. Another method which may be adopted for private use is the ear notching system in connection with which a "V"-shaped notch is cut out of the edge of the

ear with an ear notcher. A convenient marking system for up to several hundred pigs is shown in Fig. 1. Use of such a system will greatly improve selection, as litters and pigs are identified.

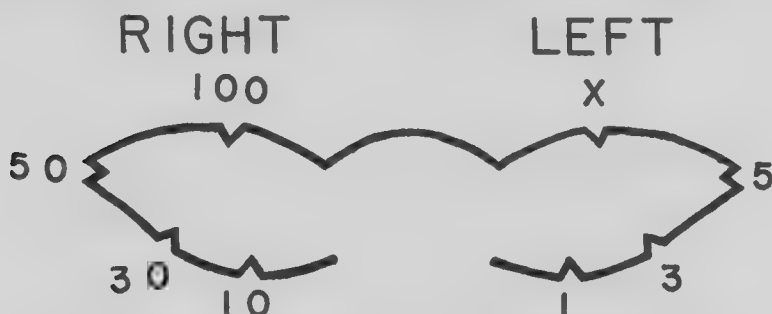


Fig. 1.—System of notching pig's ears for identification purposes,

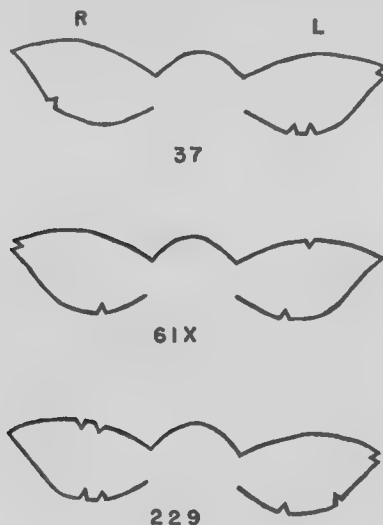


Fig. 2.—Example of the use of the ear notching system.

Various combinations may be worked out. The right ear may be used to identify litters with all one litter being marked in the 20's, all the next in the 30's, etc. The left ear may be used to identify individuals within each litter. The first 10 pigs are notched 0 to 9, with the eleventh pig receiving an X, and the twelfth IX, etc. Examples are shown in Fig. 2.

In additional explanation, it may be noted that two notches at the bottom of the left ear where the 1 is placed equal 2, or two similar notches on the right ear equal 20. A notch at 1 and 3 on the

left ear equals 4 or a notch at 1, 3 and 5 equals 9. Similar notches on the right ear would equal 40 and 90 respectively.

Litter Records

A simple form for recording each litter's birth, weaning, growth, maturity and market information is shown in Fig. 3.

Dam U.A. 105L York Sire 14N York
 Date of Birth of Dam Mar. 11, 1956 Date of Birth of Litter Mar. 4, 1959

Ear Notch	Sex	Birth Weight	3 Weeks Weight	Date at Market Weight	Type Score	Age to Market Weight	Market Grade	Remarks
20	F	2.9	13.2	Sep. 16	3	196	A	
21	F	2.8	12.3	Aug. 26	3	175	A	
22	M	3.1	14.0					Died Apr. 7
23	M	3.4	15.4	Jul. 22	1	140	C	
24	M	3.0						Died Mar. 5
25	M	2.5	13.0	Aug. 12	3	161	A	
26	M	2.7	9.8	Aug. 19	2	168	B ₁	
27	M	3.4	12.8	Aug. 5	2	154	B ₁	
28	M	3.3	13.6	Aug. 12	3	161	A	
■								
OX								
1X								
Total		27.1	104.1		17	1155		
No.		9	8		7	7		
Av.		3.0	13.0		2.4	165		

Fig. 3.—Litter Record Form.

At notching soon after birth, the ear notch, sex and birth weight are entered. At or near weaning each pig is weighed individually. A weight should be taken at a standard age prior to or at weaning as a measure of the milking ability of the dam. All pigs at the University are weighed at three weeks although some are not weaned until four weeks on the early weaning schedule. Those who wean at older ages could weigh at either 4, 5 or 6 weeks providing all pigs are weighed at a standard age.

The date at which each pig reaches market weight at about 200 lb. should be recorded. This is a convenient and appropriate time to appraise an animal for type and conformation. Barrows are

sorted out for marketing, and decisions are necessary as to which gilts are to be saved and which are to be culled for slaughter. A type score has certain limitations, but is suggested as a useful record to keep where more accurate appraisal of carcass merit is not obtainable.

There are two main considerations in scoring for type and conformation: (1) appraisal of market acceptability, and (2) appraisal of general soundness and vigor. Considerations relative to (1) are length of body, fullness of ham, and indications of muscling with freedom from excess fat and flabbiness. In relation to (2), soundness of feet and legs, vigor and the presence of at least 12 functional teats are important attributes of prospective breeding animals.

It is suggested that a score of 1 to 3 may be allotted for type as follows:

(1) potential breeding stock with a score of 1 - long, meaty animals which are sound and vigorous, and possess 12 or more well developed teats;

(2) intermediates with a score of 2 - retain breeding stock from this group only when insufficient replacements are available from group 1;

(3) definite culls with a score of 3 - short, chuffy types as well as those which are unsound or lack vigor.

The age to market weight is calculated from the birth date to the date at market weight. If the grade of pigs marketed is known it should be recorded.

Figure 3 shows a complete set of records from a typical litter raised at the University of Alberta in 1959. Specific use of records in a selection program is covered in the section beginning on page 21.

Sow Progeny Records

A second kind of record should be kept for each sow based on her own productivity and on that of her progeny. A useful form is illustrated in Fig. 4.

Sow No. U.A. 105L York Date of Birth March 11, 1956

Sire of Litter	Breed of Sire	Litter No.	Litter Birth Date	No. of Pigs Born Alive	Av. Birth Weight	No. of Pigs Weaned	Av. 3 Week Weight	Av. Age to Market Weight	Av. Type Score	Market Grades
214K	York	1	Feb. '57	11	2.6	11	11.3	170	2.9	4A, 1B,
538I	Lacombe	2	Dec. '57	10	3.0	10	13.2	199	2.7	6A, 3B,
214K	York	3	Jun. '58	15	2.4	10	10.1	211	2.7	7A, 3B,
14N	York	4	Mar. '59	9	3.0	8	13.0	165	2.4	4A, 2B, 1C

Fig. 4.—Sow Progeny Record Form.

The Sow Progeny Record Form is a summary of information recorded on the Litter Record Form. It makes possible quick comparisons between sows based on their productivity and that of their litters.

Other Useful Records

The major problem in producing high quality pork and bacon is one of reducing the proportion of fat and increasing the proportion of lean. At the University of Alberta tests have been conducted with a Lean-Meter,¹ a Purdue University device which measures the backfat thickness on the live animal. This instrument has proven to be quite accurate in estimating the fat in a carcass. Measurement of the backfat at or near market weight would be excellent supplementary information for use in selection of both gilts and boars.

Selection

Selection is the saving of certain animals for breeding stock and the culling of others. It implies differential reproduction whereby selected animals are encouraged to have many offspring while others are not allowed to reproduce. Animals which are saved for breeding purposes should show superior performance in regard to economic characteristics. Comparison of the complete performance records of potential breeding stock should be the basis for selection and culling practices.

Selection can perhaps best be dealt with in three separate phases: (1) selection of gilts, (2) culling of sows, and (3) selection of boars.

Selection of Gilts

Final selection of gilts to go into the breeding herd should be made at or near market weight. It is important that gilts compared at this time have had similar feeding and management in order that any differences observed will truly be hereditary differences. It is also important that gilts be handled in a manner similar to market pigs because their performance will then be a better indication of what to expect from their offspring.

No honest appraisal can be made of the breeding worth of gilts which have been given special feed, care and management. All gilts should be fed growing and finishing rations until they reach market weight (see pages 63 to 69) at which time they should be put on a gilt ration as outlined on page 52. The practice of removing one or a few gilts from an indoor fattening pen to outdoor competition with mature sows of various ages should be avoided. Gilts should be kept in separate outdoor quarters until they are properly hardened.

¹For information write to Duncan Electric Manufacturing Co., Lafayette, Indiana.

Selected gilts should (1) be from sows which have consistently farrowed and weaned large litters, (2) have reached market weight in minimum time, and (3) have desirable market type. It would be desirable as well to choose gilts whose litter mates and other full sibs have achieved top market grades.

Culling of Sows

Gilts should farrow and wean large thrifty litters when they are at or near one year of age. Enough gilts should be bred so that a few can be culled on the basis of their first litter productivity. The number of pigs farrowed measures the prolificacy or fertility of the sow, while the number weaned and the total weaning weight of



Fig. 5.—A group of Yorkshire sows.

the pigs measure the mothering ability. Both measures are extremely important in the culling of sows.

Records at the University of Alberta indicate that mature sows will farrow as many as 3 more live pigs than will gilts. Generally, because of greater mortality due to overlaying, mature sows will wean only in the neighborhood of one pig more than gilts. These facts should be considered in the comparison of records made by mature sows and gilts. Other characteristics recorded on the Sow Progeny Record Form (Fig. 4) will aid in making a decision as to which sows to save.

Selection of Boars

The selection of a herd boar is extremely important. In a strictly commercial enterprise the boar will probably be purchased. High

standards of performance should be demanded in a herd boar, and it is obvious that he should be purchased from a breeder who maintains adequate performance records. The herd boar should be from a dam which has consistently farrowed and weaned large litters. A top boar will have reached 200 lb. in about 5 months or less, have superior market type, and be strong on his feet and legs. A carcass record on tested litter mates, tested full sibs, or a carcass record on the test progeny of both the sire and the dam will aid greatly in selecting a herd boar.

Efficiency of feed utilization, although not mentioned in the selection of gilts and sows, is extremely important and would be a valuable aid in appraising a prospective herd boar. His own feed conversion record from weaning to 200 lb. would be most desirable, but lacking this the feed conversion of tested litter mates, full sibs, or the test progeny of both sire and dam would be a reasonable second best. Fortunately rapid growth and efficient feed utilization are highly correlated, which means that selection of a rapid growing boar should improve the efficiency of feed utilization to some extent. If the practice of buying a boar at market weight is followed, most accurate appraisal will be possible.

Breeding Systems

Breeding or mating systems refer to the amount of inbreeding, outbreeding and crossbreeding practised. The principles of record keeping, culling and selection apply equally whichever breeding system is used. Discussion of breeding systems is presented from two points of view—that of the producer of seed stock, and that of the producer of commercial or market animals.

Breeding Systems for Seed Stock Production

The seed stock producer, with the aid of testing and selection practices based on records of performance (see page 17), should aim toward genetic purity or uniformity in order that commercial producers who buy breeding stock from him may obtain consistent results. Inbreeding is the system which produces genetic purity and prepotency. Inbreeding is the mating of related animals, and can vary in degree from close inbreeding, such as the mating of sire and daughter or of brother and sister, to mild inbreeding where the only relationship between sire and dam rests on a common grand- or great-grandparent. Inbreeding has not been popular among swine breeders. This is probably because inbreeding purifies with regard to both good and bad characteristics. It brings to light hidden recessive genes which may be undesirable. A seed stock producer should use some inbreeding in order to (1) establish relatively pure and genetically stable families and strains, (2) ex-

pose undesirable recessive genes in the population so the animals carrying them can be culled, (3) fix desirable gene combinations allowing animals possessing them to be selected and multiplied.

Experimental evidence indicates that a rigorous testing and selection program is more likely to succeed if accompanied by mild inbreeding which permits the use of outstanding animals. By this means it is possible to improve the merit of the herd by selection and to increase the purity slowly and steadily. It is important that seed stock producers early recognize their responsibility to adopt a testing and selection program for economically important traits. They should breed more from within their own herd to achieve genetic purity and use an outcross only to correct a specific fault, returning immediately to the inbreeding system after the outcross is made.

Breeding Systems for Commercial Production

The best breeding systems for commercial production differ from those best adapted to seed stock production. It has been established that the mating of unrelated animals results in more vigor and thrift than the mating of related animals. A commercial producer should take advantage of this hybrid vigor in his breeding program. Outbreeding and crossbreeding are the systems which produce hybrid vigor. They tend also to cover up defects caused by recessive genes. If good feeding and management are assumed the success of the commercial producer in a crossbreeding system will depend ultimately on how good a job the seed stock producer has done in breeding for purity and selecting for performance. The use of outstanding boars of the appropriate breeds is most important in a successful crossbreeding program.

Commercial breeding systems are grading up, outbreeding, and line crossing within a breed and crossbreeding, crisscrossing, rotational crossbreeding and repeated crossing between breeds.

Grading Up

Grading up is the use of successive sires from an improved breed on nondescript females of unknown ancestry. Since only three or four generations are necessary before the graded population is essentially genetically equal to the improved breed used for grading, this system soon becomes one of either inbreeding or outbreeding. Very marked improvement through grading up is achieved in the first and second generations after which disappointing results are often obtained.

Outbreeding

Outbreeding, or the mating of unrelated animals within a breed, was for many years the most common system used in Canada both

commercially and in the production of seed stock. It is a covering up system and, if the animals used are sufficiently unrelated, fair results may be achieved. However, when a producer stays within a breed, the relationship between mated animals may be higher than expected and a drop in productivity may result. The biggest disadvantage of outbreeding is that results are extremely unpredictable.

Linecrossing

The crossing of inbred lines within a breed often gives very good results, providing the lines "nick." Unfortunately there are too few inbred lines in any swine breed in Canada to make this system available to the commercial producer.

Crossbreeding

Crossbreeding is the crossing of animals from different breeds. Many crossbreeding experiments have been conducted in both Canada and the United States with the majority indicating superior performance of crossbreds when compared to purebreds.



Fig. 6.—A group of Lacombe sows.

Several years of experimental crossbreeding at the University indicate that hybrid vigor is expressed mainly in numbers born alive, survival, rate of growth and general health and thrift. There is usually only a small advantage in efficiency of feed utilization and carcass quality; these seem to depend more on the individuals than on the breed.



Fig. 7.—A Lacombe x Yorkshire crossbred gilt.

Although crossbreeding has been employed for commercial swine production in Canada, there are two main reasons why it has not been as successful as might have been expected. Relatively indiscriminate crossing or mongrelization has been practised and the wrong breeds have often been used. Recent experimental information indicates that the greatest success from crossbreeding can be realized when a definite plan is established and adhered to. Choice of breeds and individuals which have superior performance is very important. New tried and proven breeding plans as well as improved breeds and strains of bacon type should make crossbreeding more attractive in the future.

Crossbreeding Plans

Two breeds can be crossed commercially with all the offspring marketed. This system has the disadvantage that all replacements, both male and female, must be bought and also does not take advantage of the superior productivity of the crossbred sow.

Table VI compares the productivity of purebred Yorkshire sows with Lacombe x Yorkshire sows farrowed at the University during 1957. Both groups were bred to purebred Yorkshire boars. The crossbred dams farrowed and weaned more and larger pigs than the purebreds.

Three systems involving the use of crossbred sows which have been tried and proven at various experimental stations are criss-crossing with two breeds and rotational crossing and repeated crossing with three breeds.

TABLE VI.—COMPARISON OF THE PRODUCTIVITY OF PUREBRED YORKSHIRE
AND LACOMBE X YORKSHIRE CROSSBRED GILTS AND SOWS DURING 1957

Breeding of Dam	Yorkshire			Lacombe x Yorkshire		
Age of Dam	Gilt	Sow	Av.*	Gilt	Sow	Av.
No. of litters	7	19	26	10	10	20
Av. no. pigs born	9.4	11.4	10.4	11.4	12.7	12.0
Av. no. born alive	8.7	9.5	9.2	10.4	11.2	10.8
Total live wt. of litter at birth	lb. 22.5	23.3	22.9	27.1	32.5	29.8
Av. pig birth wt.	lb. 2.6	2.5	2.5	2.6	2.9	2.8
No. pigs alive at 8 weeks	8.4	7.3	7.3	8.9	8.9	8.9
Total litter wt. at 8 weeks	lb. 221	213	217	269	271	270
Av. pig wt. at 8 weeks	lb. 26.2	29.3	27.8	30.3	30.4	30.3

*Equal weight for gilt and sow litters.

Crisscrossing

Crisscrossing involves the alternate use of boars from two breeds. Female replacements are selected from the herd. A five generation pedigree involving crisscrossing with Lacombe and Yorkshire boars is given in Fig. 8.

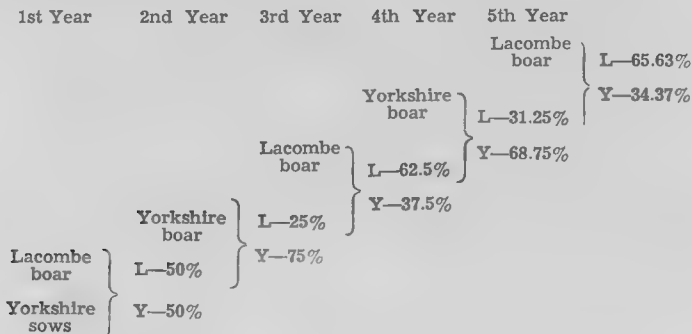


Fig. 8.—Pedigree showing 5 generations of crisscross swine breeding.

Rotational Crossbreeding

Rotational crossing usually involves only three breeds but can include more. Rotational crossbreeding with Yorkshire, Tamworth and Lacombe breeds is shown diagrammatically in Fig. 9.

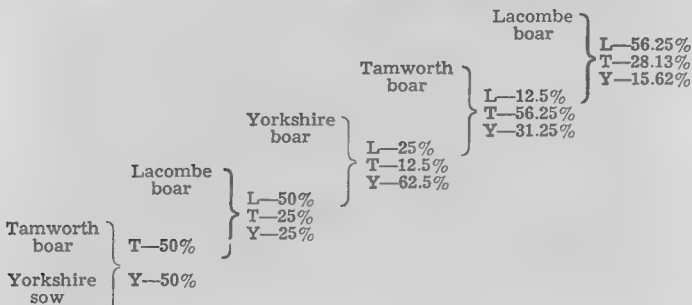


Fig. 9.—Pedigree showing 5 generations of rotational crossbreeding.

Crisscrossing and rotational crossbreeding have the advantage that gilts can be saved from the herd for replacements. They present some problems in one-boar herds since all the sows should be replaced at one time and a new boar must be purchased for each new set of gilts saved. If the herd is large enough for two boars crisscrossing is a fairly simple procedure and if three boars are used rotational crossbreeding is quite feasible. It will merely be necessary in these cases to identify the replacement gilts as to the breed of their sire and split the breeding herd into two groups for crisscrossing and into three breeding groups for rotational crossbreeding.

Repeated Crossing

The repeated or three-way cross is the mating of a crossbred sow to a boar of a third breed. All offspring are marketed. This is theoretically the best system for utilizing hybrid vigor but has the disadvantage that separate supply herds are required for both boar and gilt replacements. The offspring from the repeated cross will be more uniform than from the two continuous crossing systems and colored breeds can be worked into the program as long as the final boar is pure for white (see page 30) to guarantee all white offspring.

Important Considerations in Setting Up a Crossing Program

Crossbreeding yields hybrid vigor which is expressed in swine mainly by improved fertility, survival and growth rate. The benefits obtained when any two breeds are crossed depends on (1) the performance of each breed used, (2) the lack of relationship in the ancestry of the two breeds, and (3) specific "nicking" ability determined by an experimental test.

Crossbreeding does not guarantee carcass quality, in fact carcass quality seems more dependent on the merit of individuals used than on the breeds.

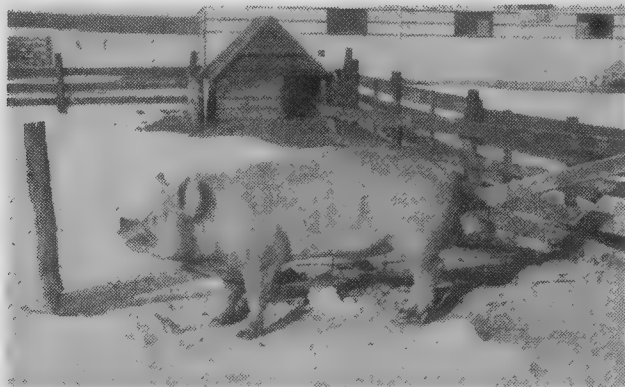


Fig. 10.—Yorkshire boar, 214K, used extensively at the University of Alberta (see Table VII).

Table VII summarizes a comparison of offspring of two purebred sires of four different breeds during 1958-59. Most of the dams were Yorkshire but comparisons are strictly valid only between sires within each of the four breeds. It can be seen that age to market is influenced by hybrid vigor while carcass quality measures show greater variations between offspring from sires of the same breed with the exception of the Lacombe-sired groups. These data indicate the importance of careful selection of both individual and breed for use in crossbreeding programs.



Fig. 11.—Tamworth boar, 937L, used in crossbreeding studies at the University of Alberta (see Table VII).



Fig. 12.—Lacombe boar, 5381, used at the University of Alberta (see Table VII).

TABLE VII.—COMPARISON OF OFFSPRING OF TWO SIRES FROM EACH OF FOUR BREEDS—1958-59

Breed of Sire		Yorkshire		Lacombe		Landrace		Tamworth	
Sire	No.	214K	70M	H555	5381	FN 1	50M	937L	2K
No. of pigs		52	87	60	41	41	15	107	97
Av. market age .. days		184	185	163	168	170	164	154	156
Grades:									
A	%	68.9	46.1	55.6	52.8	62.2	23.1	49.0	37
B	%	26.2	43.4	40.7	43.4	37.8	76.9	47.0	51
C	%	4.9	10.5	3.7	3.8	0	0	3.0	12
Av. carcass length, in.		31.5	30.7	30.8	30.7	30.6	31.2	30.7	30.0
Av. backfat	in.	1.36	1.54	1.50	1.50	1.45	1.56	1.51	1.55
Av. area of loin, sq. in.		3.80	3.70	3.98	3.83	3.59	3.66	3.64	3.47
Av. total A.R. score ..		82	70	75	74	75	68	69	60

Color Inheritance

Since the Canadian grading system discriminates against black skin or hair roots it may be desirable in a crossing program to attempt to raise pigs which are white or red. With this in mind some of the color expectations from different crosses are listed below.

(1) Yorkshire x Berkshire—all white offspring unless the Yorkshire is impure for white in which case one-half will be black and one-half white.

(2) Yorkshire x Tamworth—mostly all white with some sandy and an occasional red and white. If the Yorkshire is impure for white one-half will be white and one-half will be red and black.

(3) Yorkshire x Lacombe }
 Yorkshire x Landrace } all white
 Lacombe x Landrace }

(4) The Landrace will behave in crosses similar to the Yorkshire.

(5) Tamworth x Berkshire—all red and black pigs.

(6) The Lacombe will have all white offspring in any cross except occasional sandy or reddish pigs when crossed with the Tamworth. No Lacombe pigs are being released until they are tested for purity regarding the white factor.

If white or red pigs used have black hair spots, more black hair spotting will show up in the offspring than is illustrated above. Pigs with black hair should therefore not be chosen for breeding purposes.

FEEDING AND MANAGEMENT OF SWINE

In raising swine, considerable progress has been made when the correct breeding stock have been secured (see pages 21 to 23) but the ideal in bacon hog production will not be attained unless the best feeding and management methods are followed. The aim in the pig business should be the marketing each year of a maximum number of high quality pigs on a minimum amount of feed, or, in other words, economical production.

During the past 42 years approximately 200 swine feeding experiments have been conducted at the University of Alberta Live-stock Farm. The object of the discussion which follows is to present to swine raisers a review of recommended swine feeding and management practices based largely on the results of experiments conducted during this period.

COMPOSITION OF COMMON SWINE FEEDS

Before commencing a discussion of feeding and management it is of interest to consider some facts relative to the chemical composition of common swine feeds and to draw some general comparisons between the various feeds available to Alberta swine producers.

Chemically the various components of feeds may be grouped under the following headings; water, protein, carbohydrates, fat, fiber, ash and vitamins. Each of these groups plays a definite and different part in connection with body maintenance and growth.

The water content is determined because the less moisture a feed contains the higher its feeding value, pound for pound. Cereals which are damp or tough do not return as good value for each 100 lb. fed as those of lower moisture content.

The protein contains all the nitrogenous compounds, and this part of the feed is used to produce lean meat. The demand for protein of high quality is very heavy in young growing bacon pigs, pregnant sows and sows nursing litters. Such feeds as skim-milk, meat scrap, fish meal and soybean oil meal are rich in protein.

The carbohydrates compose the starchy portion of the feed, and are largely used to supply the heat and energy required by the pig and for the production of fat in the body. All cereal grains are rich in carbohydrates.

The term fat, when used in connection with the composition of a feed, embraces not only true fat but certain fat-like substances. The fat is used largely for the same purposes as the carbohydrates, namely, heat and energy and the production of body fat.

The fiber is the part of the feedstuff which is of least use to the pig. Oat hulls consist largely of fiber and are to a large extent indigestible. Cattle and sheep can make considerable use of fibrous feeds because they have a large rumen, but the pig with its small stomach, can make little use of such feeds and they may be harmful to young pigs.

The ash contains the mineral constituents of the feed. The ordinary farm-grown grains are very low in ash. The hays and grasses contain more ash, with legumes, such as alfalfa and the

clovers, being very rich in mineral matter, especially calcium. Since pigs are fed largely on cereals, it is necessary to pay careful attention to supplements of calcium and iodized salt.

Vitamins A and D are absent from our cereal grains and must be supplemented in hog rations. Other vitamin supplements may be required in rations of young pigs. Certain feed additives, particularly antibiotic feed supplements, are now in routine use for pig feeding and these have a place in practical hog production.

Table VIII shows the average percentage composition of various feeds and is a valuable guide in arriving at relative values of these feeds. Feeds, particularly grains, may vary a great deal in composition, however, and for that reason swine producers are advised to make use of the **Agricultural Soil and Feed Testing Laboratory, University of Alberta, Edmonton.**

TABLE VIII.—PERCENTAGE COMPOSITION OF SOME COMMON SWINE FEEDS*

	Water	Protein	Carbo- hydrates	Fat	Fiber	Ash	TDN**
	%	%	%	%	%	%	%
Barley	10.6	12.7	66.6	1.9	5.4	2.8	70
Oats	9.8	12.0	58.6	4.6	11.0	4.0	65
Oat groats	9.6	16.2	63.7	6.1	2.2	2.2	92
Wheat	10.5	13.2	69.9	1.9	2.6	1.9	81
Corn, Dent	15.0	9.1	68.7	3.9	2.1	1.3	80
Rye	10.5	12.6	70.9	1.7	2.4	1.9	75
Bran, wheat	9.9	16.4	53.1	4.5	10.0	6.1	57
Skimmilk	90.5	3.6	5.1	0.1	0.0	0.7	9
Meat scrap	5.8	54.9	2.5	9.4	2.5	24.9	68
Fish meal, herring	6.5	72.5	1.5	7.3	0.7	11.5	71
Soybean oil meal	9.6	45.7	31.4	1.3	5.9	6.1	75
Linseed oil meal	8.3	37.5	34.6	5.9	8.2	5.5	68
Potatoes	78.8	2.2	17.4	0.1	0.4	1.1	21
Dehydrated alfalfa meal	7.3	17.7	38.4	2.5	24.0	10.1	45
Alfalfa hay	9.5	15.3	36.7	1.9	28.6	8.0	30
Mixed legume-grass							
pasture	78.0	3.8	9.9	1.0	5.3	2.0	13
Oat pasture	85.9	3.2	5.5	0.6	2.8	2.0	—
Silage	72.4	3.2	11.1	1.1	9.7	2.5	—

*From Morrison's "Feeds and Feeding", twenty-second edition.

**The Total Digestible Nutrients are an evaluation of the digestible energy in a feed. Based on Schneider's "Feeds of the World".

SWINE FEEDS AVAILABLE IN ALBERTA

The discussion which follows, when considered in conjunction with the figures dealing with chemical composition, should form a basis for evaluating the common swine feeds and of getting the greatest value for money spent when feed is purchased.

Grains and Grain Byproducts

Grains alone are inadequate for pigs raised inside. This is demonstrated by the results of an experiment conducted in 1958-59 and summarized in Table IX. The feeding of wheat, barley or oats alone or the 3 grains in combination resulted in very poor gain, low feed consumption and poor feed efficiency. Of the 64 pigs fed on

the grain rations, 46% failed to reach market weight. Carcasses from the pigs fed grain alone were lacking in loin area.

TABLE IX.—RESULTS OF FEEDING GRAINS ALONE AS COMPARED TO GRAINS PLUS A COMPLETE PROTEIN SUPPLEMENT*
(SUMMARY AFTER 10 WEEKS ON TRIAL)

	Grain alone	Mixed grain + protein supplement
No. of pigs	64	48
Av. daily gain	0.61	1.52
Av. daily feed	2.72	4.58
Feed req'd for 100 lb. gain	446	301

*All pigs had free-choice access to minerals and received vitamins A and D.

Grains form the basis of most swine rations so their relative value should be discussed.

Barley

The results of a number of experiments justify the conclusion that for bacon hogs the higher the percentage of barley in proportion to oats fed, the less feed is required to make growth, and the larger the returns for feeding under normal price relationships. An average result of 3 experiments is presented. In these experiments the various grain mixtures were fed in conjunction with skim milk to pigs running on pasture from weaning to market weight.

TABLE X.—RESULTS OF FEEDING VARIOUS MIXTURES OF OATS AND BARLEY

	LOT I Oats 2 Barley 1	LOT II Oats 1 Barley 1	LOT III Oats 1 Barley 2	LOT IV Oats 1 Barley 3	LOT V Barley Alone
No. of pigs	20	20	20	20	19
Av. daily gain	1.28	1.31	1.33	1.35	1.37
Feed req'd. for 100 lb. gain:					
Grain	298	296	288	288	285
Skim milk	581	569	557	552	551

Wheat

Wheat has not been commonly thought of as a pig feed unless in the form of the frozen or lower grades, but in recent years, owing to the establishment of quotas or a shortage of coarse grains in some areas, the place of wheat in swine rations has come prominently to the fore.

An experiment in which pigs were allowed to help themselves to ground wheat, oats or barley from separate self-feeders, indicated that they showed a decided preference for wheat. Because of its palatability and high energy content, wheat is the grain of choice in creep feed rations.

On the basis of an experiment conducted at the University of Alberta during the winter of 1951-52, No. 5 and feed wheat produced more efficient gains than barley when fed to growing and finishing swine. Carcass grades were lower on the high energy wheat ration. An experiment in 1956 indicated that somewhat higher protein

levels are required to give best results with a wheat ration as compared to a barley or oat ration for growing pigs.

Oats

Oats may be used as part of the grain mixture for growing and finishing pigs, and as 50% of the ration for breeding stock, but we would not recommend that they be fed as a sole grain to any class of pigs. Our experimental work indicates that Grade A bacon hogs can be produced more efficiently and with less trouble from intestinal irritation or enteritis if oats are limited to not over 25% of the ration, particularly for pigs under 100 lb. in weight. The use of the heavier grains, such as barley and wheat, reduces the percentage of hull in the ration, and the young pigs are able to make better use of the feed consumed.

For finishing hogs, a high percentage of oats in the ration will normally improve carcass quality, although feed efficiency is reduced as pointed out in Table XI. The results reported in this table are based on 2 experiments conducted in 1954-55 using a complete supplement with pigs fed in the barn.

TABLE XI.—COMPARISON OF OATS AND BARLEY FOR FINISHING HOGS

	Oats	Barley
No. of pigs	16	16
Av. daily gain lb.	1.32	1.54
Feed required for 100 lb. gain lb.	459	421
Carcass grades:		
A	12	9
B ₁	4	7
Average Advanced Registry Score %	73	68

Oat Groats and Hullless Oats

Oat groats and hullless oats are high energy, low fiber feeds with a feeding value similar to wheat. They are useful in creep feed or early prestarter rations if the price relationship to wheat is satisfactory. An experiment in 1959 indicated that for growing and finishing pigs, hullless oats had a feed value equivalent to wheat.

Comparative Value of Barley, Wheat and Oats

Wheat and barley are high energy grains and can be used more or less interchangeably. The bushel weight of grains is indicative of the feed efficiency that can be expected from these grains.

Some idea of the comparative value of the three common farm grains for growing pigs may be gained from an experiment conducted during the summer of 1933 with growing and finishing pigs fed in drylot without pasture. Tankage was added to the ground grains at a rate of 8%, and the pigs had access to a simple mineral mixture.

The pigs fed barley and wheat grew at about the same rate and more than one-tenth of a pound per day faster than those fed oats.

In this experiment the amount of gain produced by 100 lb. of ground oats was produced by 92 lb. of barley, 87 lb. of wheat and 79 lb. of grain when the three were mixed.

Rye

Compared with grains already discussed rye is an inferior pig feed, lacking in palatability and inefficient in promoting growth when fed alone. In experiments conducted with finishing pigs, rye was only worth 70% as much as barley. When mixed as not over 50% of the ration with other grain it can be used satisfactorily and economically for finishing pigs. Rye containing as much as 0.1% ergot should not be fed to any class of pigs.

Corn

This cereal does not occupy a prominent position in pig feeding in Alberta. When mixed with other grains and balanced with milk or other suitable supplements, it might constitute from one-quarter to one-third of the ration for bacon hogs.

Damaged Grains

Although not studied at the University of Alberta, evidence from other Canadian institutions indicates that grains damaged by frost, molds, sprouting, rusts, smuts, or fire are normally satisfactory feeds for pigs. Moldy and burnt grains are less palatable than normal grains. Some caution should be used at the start in feeding damaged grains, particularly those that are moldy.

Screenings

Screenings of the quality of "No. 1 Feed" containing mainly small cracked grains, wild oats, buckwheat, and free from mustard and similar seeds, constitute a useful pig feed. In experiments conducted a number of years ago, pigs fed ground screenings of the above quality along with tankage made reasonable daily gains and required 394 to 454 lb. of feed to make 100 lb. of gain. The screenings were marketed through the pigs at a substantial profit.

Light, chaffy screenings are high in fiber, and consequently low in feeding value. Legume seed screenings were found to be unpalatable and of low value as pig feed in experiments conducted during 1948-49 at the University of Alberta.

Weed Seeds

While weed seeds are usually utilized in the form of screenings and are thus fed mixed with small or cracked wheat or other grains, there may be times when they are available in more or less pure form. Wild oats has a feeding value similar to good feed oats. Wild buckwheat and pigweed seed when mixed with grains can be made

use of in pig feeding. In an experiment conducted at the University of Alberta during the winter of 1937-38, it was found that pigweed seed had a feeding value of approximately 90% of that of oats. Seeds of the mustards and stinkweed are unpalatable and pigs will usually refuse to eat mixtures which contain these seeds in any quantity. Such weed seeds may even cause an objectionable flavor in the fat of pigs. All weed seeds should be well ground before feeding so that they are no longer viable.

Shorts and Middlings

Shorts and middlings are very desirable pig feeds, particularly for young pigs which find them to be extremely palatable. These byproducts have the same deficiencies as grains; therefore, we concluded after a series of experiments that they cannot be used with profit unless they can be purchased at a smaller cost per pound than grains are worth on the farm.

Bran

Bran may be used with advantage at a level of 1 to 2 lb. per day for brood sows prior to farrowing and immediately after farrowing as it is bulky and laxative. Ordinarily price limits its place in economical pig feeding. Experiments conducted at the University of Alberta during 1949 and 1950 indicated that the dilution of a finishing ration with 20% bran tended to decrease the rate of gain by approximately 0.15 lb. per day, and to increase the feed required per 100 lb. gain by about 40 pounds.

Supplemental Fat

In addition to grain, another possible source of energy in swine rations is stabilized fat. Low levels of fat up to 5% of the ration may improve the texture of the feed, but as a source of energy a pound of fat can only be valued at approximately 2¼ times the price of a pound of grain. Studies are in progress at the University of Alberta on the value of fat in swine rations.

Roots

While roots may not be regarded as a necessity in pig feeding when they are available they can be used to good advantage particularly for brood sows where they provide bulk and succulence. For growing pigs they tend to utilize too much valuable space in the digestive tract. Potatoes may be boiled and used to replace up to 50% of the grain in a ration. It was found that 411 lb. of cooked potatoes equalled 100 lb. of grain in feeding value.

Protein Supplements

In swine feeding the quality of protein is equally as important as the quantity. Proteins are built up of amino acids, 10 of which

are essential for the pig, and it is the presence of the proper proportion of these amino acids that makes some protein supplements more valuable than others for pig feeding. Lysine is usually the first limiting amino acid in swine rations. This amino acid is now being manufactured and may soon be available at a price where it can be profitably added to rations.

Skim milk

Pig raisers who have skim milk available are in a fortunate position. It is valuable in compensating for some of the deficiencies of farm-grown grains, and when used to supplement the cereals may make for very economical production.

In an experiment conducted in 1958-59, skim milk supplemented with free-choice minerals plus vitamins A and D gave as good gain and feed efficiency in pigs from 30 lb. to market weight as a complete mixed supplement. A summary of the results is given in Table XII. The grain mixture was equal parts by weight of barley, wheat and oats.

TABLE XII.—COMPARISON OF SKIM MILK AND A COMPLETE MIXED SUPPLEMENT

		Skim milk	Mixed Supplement
No. of pigs		16	16
Av. daily gain	lb.	1.56	1.62
Av. daily feed	lb.	4.71*	5.49
Feed req'd per 100 lb. gain	lb.	302	339
Grade A	%	75	69
Av. A.R. score	%	80	77

*Milk converted to a dry matter basis.

The value of skim milk depends upon the rate at which it is fed. We recommend the following proportions of grain and skim milk:

Weaning to 75 lb.	2.5 lb. to 1 lb. of grain
75 to 110 lb.	2 lb. to 1 lb. of grain
110 lb. to market weight	1 lb. to 1 lb. of grain
Lactating sows	1.5 to 2 lb. to 1 lb. of grain

Based on the 1958-59 experiment and on earlier experiments, skim milk on the farm has the following value in relation to grain and supplement prices.

TABLE XIII.—VALUE OF 100 LB. OF SKIM MILK IN HOG FEEDING

Grain price per lb.	Complete Supplement price per lb.		
	4c	5c	6c
1c	38c	45c	52c
1.5c	43c	50c	57c
2c	48c	55c	62c
2.5c	53c	60c	67c
3c	58c	65c	72c

Dried skim milk has similar properties to skim milk, except that it is approximately 10 times as concentrated. Despite the high supplemental feeding value of dried skim milk, it is generally too expensive to be an economical protein supplement for swine, except for very young pigs.

Buttermilk

What has been said regarding the place of skimmilk in pig feeding holds equally well for buttermilk as it comes from the churn. Buttermilk diluted with wash water will have a lower feeding value.

Meat Scrap and Feeding Tankage

Meat scrap is a packing house byproduct consisting of thoroughly cooked and sterilized meat and bone scraps. Tankage is a similar product and the general discussion which follows may be applied to it as well as meat scrap. In a trial conducted in 1955 at the University, the use of either feeding tankage or meat scrap as supplements for growing pigs resulted in almost identical growth rates and efficiency of feed utilization.

In trials conducted in 1949, 1950 and 1955 similar rates of gain and feed efficiency were obtained when pigs were fed a protein supplement containing 50% meat scrap or a protein supplement of mixed vegetable origin. The economy of meat scrap versus soybean oil meal will depend largely on the prevailing price of these supplements, recognizing that meat scrap is a calcium and phosphorus supplement as well as a protein supplement.

There is some variability in the feeding value of meat scrap, and only a limited volume of the supplement is available. Therefore, meat scrap can be used to best advantage when incorporated in mixed supplements.

Fish Meal

Fish meal is recognized as an extremely good quality protein supplement. For example, in an experiment conducted in 1955 with growing pigs from weaning up to 90 lb. in weight, a herring meal supplement added to a barley ration resulted in gains of 1.33 lb. per day and a feed efficiency of 295 lb. feed per 100 lb. gain which was superior to results obtained from several other supplements based on soybean oil meal, meat scrap or tankage.

Under usual price conditions the general use of fish meal as a supplement cannot be recommended. It may be added in limited quantities to improve a supplemental mixture, particularly for young pigs being creep fed, or immediately after weaning.

A generally acceptable recommendation is that 1/5 of the protein supplement added to a ration should be of animal origin.

Soybean Oil Meal

Of the plant protein supplements available in Alberta, soybean oil meal, when properly processed, has considerably the highest supplemental value for pig feeding. Although it is not recommended that it should be used to replace entirely supplements of

animal origin, experiments at the University of Alberta indicate that on an equal protein basis it has as high a value as meat scrap.

Linseed Oil Meal

While linseed oil meal may be fed as a portion of a mixed protein supplement, it does not have a high value as a sole protein supplement for growing pigs as it is deficient in the same amino acids as are the cereal grains. In experiments conducted a number of years ago, it gave the least satisfactory results of several supplements tested.

Rapeseed Oil Meal

Rapeseed oil meal is a variable product and may contain toxic principles, at least one of which disturbs the activity of the thyroid gland. Its use, in some cases, will reduce rate of gain, efficiency of feed utilization and reproductive performance. Experiments at the University of Alberta and elsewhere have resulted in the recommendation that rapeseed oil meal should not be used in creep feed and starter rations nor in sow rations. It should not form over 5% of the total ration, which is equivalent to 25% of the hog "concentrate", for growing and finishing pigs.

Other Supplements of Vegetable Origin

Supplements such as sunflower oil meal are sometimes available on the Alberta market. They may be satisfactorily used to form a portion of the protein supplement in a ration. Limited experimental evidence indicates that their protein is more valuable than linseed oil meal but less valuable than soybean oil meal.

Alfalfa Hay, Alfalfa Meal and Dehydrated Cereal Grass

For swine not on pasture, alfalfa may be an excellent source of vitamins A and D and certain B-complex vitamins, as well as a source of protein and minerals. Dehydrated alfalfa meal and cereal grasses are usually superior to field-cured meal except that they supply little vitamin D. These products should be limited to 5% of the ration for growing pigs and not used in starter rations because they are reasonably high in fiber, are relatively indigestible by the pig, and are usually costly.

Alfalfa or alfalfa-grass hay may be ground at home, thus providing a low cost meal of good quality, providing that leafy green hay is used. Such hay is a valuable feed for brood sows and may be fed as 10 to 30% of the ration, or free-choice in a rack.

Table XIV, based on a 1959 experiment at the University of Alberta, shows the relative values of 10 and 20% ground alfalfa-grass hay in the ration as a supplement for growing and finishing pigs. Rate of gain and feed efficiency were relatively poor in

comparison to a complete supplement, but when the price per lb. of excellent quality hay is well below grain and supplement prices such a system of feeding might be justified.

TABLE XIV.—USE OF ALFALFA-GRASS HAY AS A SUPPLEMENT FOR MARKET PIGS

		10% alfalfa- grass hay	20% alfalfa- grass hay	Complete supplement
No. pigs		7	8	8
Av. daily gain	lb.	1.19	1.22	1.61
Av. daily feed	lb.	5.27	5.35	5.80
Feed/100 lb. gain	lb.	446	440	360
Grade A carcasses	%	71	63	75

Mineral Supplements

In order that they may grow rapidly, pigs require an adequate supply of mineral matter, particularly salt and calcium. These minerals are lacking in our ordinary farm-grown grains and, unless the deficiency is made up by adding minerals to the feed, a lack of thrift is likely to develop and such acute conditions as stiffness and rickets may arise. Apart from the minerals mentioned, such minerals as iodine, which prevents the birth of "hairless pigs", iron, which prevents anemia in young pigs and zinc, which prevents parakeratosis, may be lacking. Specific diseases arising from a deficiency of calcium are discussed in the following section, while iodine deficiency, anemia and parakeratosis are discussed on pages 54, 59, and 41 respectively.



Fig. 13.—Pigs which are not receiving sufficient mineral will become crippled. This group of pigs was fed during winter at the University on a ration lacking calcium.

Calcium

Rickets and crippling in growing pigs are the most common manifestations of a lack of calcium in pig rations. In the winter or with pigs kept inside away from sunlight, lack of vitamin D may aggravate this condition. It should be remembered that while a deficiency of calcium or vitamins in weanling pigs may not be

great enough to produce marked symptoms, it may be sufficient to lower resistance to other diseases, with results equally as disastrous. That pigs respond to the feeding of ground limestone when there is a lack of this mineral in the feed is shown by the results of an experiment conducted in the piggery during the winter of 1935-36.

TABLE XV.—FEEDING GROUND LIMESTONE

	LOT I Grain No Limestone	LOT II Grain, ½% Ground Limestone
No. pigs in lot	7	7
Av. initial wt. lb.	46	45
Av. final wt. lb.	176	206
Av. daily gain lb.	0.81	1.04
Feed req'd. for 100 lb. gain:		
Grain lb.	514	467
Mineral lb.		2.4

The pigs which did not receive the mineral grew more slowly and required more feed to make their gains than those fed the ground limestone, and in addition two pigs in Lot I became badly crippled during the experimental period.

Paralysis of the hind quarters occurs occasionally in brood sows, most frequently just prior to farrowing. The cause is often a lack of calcium and essential vitamins. The sow, when down, should be given a laxative diet with an ample supply of green feeds. Sows so affected may sometimes be brought back to their feet with the use of calcium preparations, but this requires the services of a Veterinarian. Prevention, however, is much more certain than cure, and for this reason the pregnant sow must receive a good nutritious ration as discussed on page 53.

Phosphorus

Lack of phosphorus may also cause lameness and rickets but phosphorus is seldom lacking in swine rations. In experiments conducted in 1953-54, addition of bonemeal failed to improve the rate of gain or feed efficiency in pigs fed rations adequately balanced with salt and limestone. For pigs, particularly sows, on pasture a phosphorus supplement as 20% of the mineral mixture is desirable.

Iodized Salt

All pigs require salt in their rations, and, as much of Alberta is an iodine-deficient area, iodized salt should be used. Salt poisoning of pigs can occur but usually only when water intake is restricted or when a concentrated brine is fed.

Zinc and Parakeratosis

Parakeratosis is a disease accompanied by severe dermatosis (scurfiness) of the skin, and unthriftiness. This disease has occurred in numerous swine herds in Alberta, including the herd at the University Livestock Farm. It usually occurs shortly after

weaning but may be present prior to weaning. It has been found that the addition of 50 to 100 p.p.m. of zinc to the ration of growing pigs will normally prevent or cure the condition, even though the basic problem is probably one of calcium metabolism. Zinc oxide, zinc sulfate or zinc carbonate at levels of 1/3, 3/4 and 1/2 lb. respectively per ton of complete ration have been used successfully to combat this condition.

Other Trace Minerals

Experiments conducted in 1953-54 at the University indicated no value from various trace minerals in swine rations. Manganese is added routinely to poultry rations (usually 1/2 lb. manganese sulfate monohydrate per ton of ration) and there is indication from work in the United States that it may sometimes be of value as a supplement to swine rations. There is limited evidence that supplemental copper may be beneficial in rations of growing pigs but at present it cannot be recommended routinely.

Mineral Mixtures

A simple mineral mixture which may be used with good results by keeping it before the breeding stock and growing pigs in a self-feeder may be made up as follows:

Ground limestone	49 lb.
Iodized salt	50 lb.
Zinc sulfate, zinc oxide or zinc carbonate	1 lb.

Unless a commercial protein-mineral supplement is being fed in adequate amounts, it is advisable to mix 1/2 lb. of ground limestone and 1/2 lb. of iodized salt with each 100 lb. of ration.

Vitamin Supplements

Vitamins A and D

Under Alberta conditions, vitamins A and D appear to be the only ones likely to be deficient in swine rations. In summer with pigs on pasture, vitamin A is supplied by the pasture in the form of carotene, and vitamin D is supplied by the sunlight. In a system of management where pigs are confined, supplemental vitamins A and D are required to prevent poor growth, poor reproduction, crippled pigs and to reduce susceptibility to other ailments.

Vitamin D may be supplied by adding products such as irradiated dry yeast or dry vitamin D₂ to the ration, while synthetic dry vitamin A products are also available. These products are generally superior to feeding oils (fish oils) because of their greater stability, although in an experiment conducted at the University in 1954, no difference in gains was noted between pigs receiving their A and D in feeding oil or in dry form. Commercial supplements contain the essential vitamins in sufficient quantities. If commercial supple-

ments are not used, it is necessary to add the vitamin supplements to the ration, or to add feeding oil to the feed at the time of feeding.

Rations for growing swine should contain 1 million I.U. of vitamin A and 200,000 I.U. of vitamin D per ton, with sow rations containing $2\frac{1}{2}$ times this level of vitamin A. Based on these requirements, one may work out the amount of vitamin source to add to a ton of feed. One teaspoonful per pig per day during growth, and one tablespoonful per sow per day of a 1000A-150D feeding oil should be adequate. The vitamins in fish oils are quite unstable and are best not mixed in feed that is to be stored for more than a month. If mixed, 2 to 3 lb. of feeding oil per 1,000 lb. of ration should be used.

Other Vitamins

Trials at the University of Alberta in 1947-48 showed no benefit when riboflavin was added to typical growing rations for pigs, while an experiment in 1954-55 indicated no response from riboflavin added to a creep feed ration. Experiments from 1950 to 1952 demonstrated no positive response through growth, reproduction and lactation when supplemental calcium pantothenate was added to a typical Alberta ration. Little response has been obtained in studies over the past few years with vitamin B₁₂ feed supplements. So far as is known there is little likelihood of a deficiency of any of the other B-complex vitamins. Despite this it is probably advisable that riboflavin, niacin, pantothenic acid and vitamin B₁₂ be added to rations for young growing pigs to meet conditions of stress that may occur. Commercial supplements normally contain supplemental levels of these vitamins.

Antibiotic Feed Supplements

Since 1949 the University of Alberta has conducted numerous experiments on the use of antibiotic feed supplements in bacon hog rations. These supplements, containing antibiotics such as aureomycin, terramycin and a mixture of penicillin and streptomycin, have given large increases in average daily gain and feed efficiency under some conditions, but certain points should be observed in their use to get maximum benefits in production and economy.

Antibiotic feed supplements are extremely useful in creep feed rations and may prevent many runts at weaning. In a creep feed ration, reasonably high levels of 25 to 50 grams of antibiotic per ton of ration should be considered, as the creep feed provides only a fraction of the total feed intake.

If early weaning is practised, antibiotic supplements are necessary in the prestarter ration for success.

With unthrifty or "runty" weanling pigs phenomenal increases in rate and efficiency of gain are often obtained by the use of antibiotics. Experiments at the University of Alberta have resulted in increased rate of gain of as much as 85% by adding antibiotics to pig starter rations for unthrifty pigs. The use of antibiotic feed supplements in "creep" rations may, in turn, prevent many of these runs occurring, and help to lower the incidence of scouring.

For growing pigs, a level of 10 grams of antibiotic per ton of feed would appear to be desirable. The results of a typical experiment conducted at the University of Alberta in the summer of 1950 to study the addition of an antibiotic supplement to 2 growing rations are given below:

TABLE XVI.—ANTIBIOTIC SUPPLEMENTATION OF GROWING RATIONS

	GROUP 1 Mixed animal- vegetable protein	GROUP 2 As 1 plus antibiotic	GROUP 3 Vegetable protein	GROUP 4 As 3 plus antibiotic
No. of pigs	7	7	7	7
No. of days fed	84	70	96	70
Av. daily gain lb.	1.10	1.32	1.02	1.31
Av. daily feed lb.	4.2	4.6	3.5	4.0
Feed req'd for 100 lb. gain, lb.	378	347	344	307

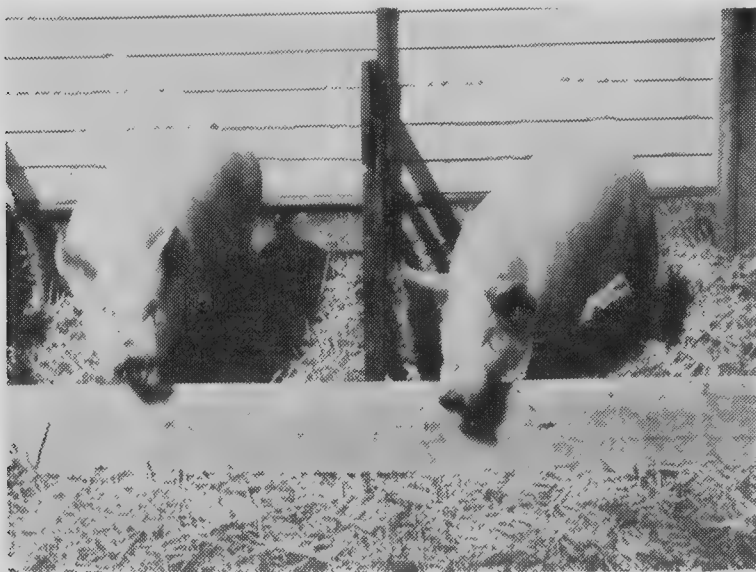


Fig. 14.—Antibiotic supplementation of swine rations. Pig on left received an antibiotic supplement throughout the finishing period while pig on right did not. Note evidence of excess backfat in pig on left.

In experiments at the University, carcass quality has usually been reduced when antibiotics were fed throughout the finishing period to hogs of average quality. This matter of carcass quality reduction is controversial and may vary with different strains of pigs. The best compromise in order to obtain maximum rate of gain and have a limited effect on carcass quality is to reduce the antibiotic level to 5 grams per ton of finisher ration. This is also the most practical approach as the complete supplement is usually reduced by 50% at this stage.

Antibiotic feed supplements give best results when fed with rations balanced in all other respects, and when fed as recommended for a particular type of production.

Other Feed Additives

Many additives such as arsonic acid derivatives, surfactants and enzymes have been tested in swine rations but at present there is little evidence to justify their use under conditions such as prevail in Alberta.

Mixed Supplements or "Hog Concentrates"

Each of the individual protein, mineral, vitamin and antibiotic supplements already mentioned can be used to advantage in pig feeding. However, the best results from the standpoint of rapid gains and economical production are secured when several of them are blended together in such proportions as will provide a complete mixture. This process may be carried out on the farm by buying the various ingredients and mixing them according to a standard formula. Difficulty is likely to be experienced in the weighing out of the individual materials and in getting a good "mix" unless a mechanical mixer is available. At the same time the labor involved is considerable, and cost of buying and storing in small lots is usually excessive.

The alternative is to purchase ready-mixed protein-mineral-vitamin supplements which are commonly referred to as "hog concentrates". The mixtures offered to swine raisers by reliable feed companies are made according to specifications which have been drawn up on the basis of experimental findings. The feeder may feel reasonably certain that, if these supplements are added to the grain in the proper amounts, and well mixed, good results will follow. The feed companies are also in a position to revise their formulas on the basis of the most recent information. This is important as new products and new research findings are constantly becoming available.

The mixing and sale of feeds by commercial concerns is regulated by the Canada Department of Agriculture through the Feed-

ing Stuffs Act. The feeds must meet certain specifications provided for in the Act and on the outside of the bag will be found information relating to the percentage of important ingredients.

Combined protein and mineral supplements which have proven reliable may be made up as follows:

	Growing pigs	Sows
Soybean oil meal*	64.75	50
Meat scrap or other animal protein	25	25
Alfalfa meal or ground hay		15
Ground limestone	5	5
Iodized salt	5	5
Zinc sulfate	0.25	.
Antibiotic supplement	**	.
Vitamin A and D supplements	***	***
	100 lb.	100 lb.

*Not over $\frac{1}{2}$ may be replaced by linseed oil meal, or similar vegetable proteins.

**To supply the equivalent of 4 gm. of antibiotic per 100 lb. of supplement.

***To supply the equivalent of 350,000 I.U. of vitamin A and 70,000 I.U. of vitamin D per 100 lb. supplement for growing pigs and $2\frac{1}{2}$ times these levels for sows. In addition, a B-complex vitamin mix is desirable.

The mixture may be modified in a number of ways, although a similar type of supplement should be used to make the substitutions. It is evident from studying the above supplement that few producers are justified in trying to mix their own "hog concentrates" but should purchase commercial concentrates unless they have adequate skim milk available.

Pasture Crops

Pasture crops can be utilized extensively in pig raising in Alberta as pasture is a decided asset in the feeding and management of



Fig. 15.—General view of experimental groups of pigs on pasture at the University of Alberta.

breeding stock and every effort should be made to supply fresh forage from spring until fall.

For growing and finishing pigs, experiments conducted at the University of Alberta indicate that when supplemental feed is not available, one may expect more rapid gains and a decrease in the cost of making gains when pasture crops are used as compared with feeding in the drylot. When proper supplements are fed pasture crops do not make a good showing with growing pigs, as illustrated in Table XVII which is a summary of two years' experiments comparing pasture versus inside pig production.

TABLE XVII.—COMPARISON OF INSIDE VERSUS OUTSIDE RAISED PIGS

From birth to weaning at 8 weeks	Inside	Inside	Outside
Weaning to market	Inside	Outside	Outside
No. pigs	50	54	53
Av. age to market days	152	168	167
Av. daily gain lb.	1.69	1.43	1.39
Feed req'd. per 100 lb. gain* lb.	349	388	429
Grade A carcasses %	54	56	43

*These figures do not include the pasture eaten by the pigs.

There is a tendency for pigs on pasture to "blister" or "sunscauld". When suitable shelter is provided close to the feed trough or self-feeder, blistering will be reduced to a minimum. When pigs do become so afflicted, a liberal application of mineral oil to the affected parts will help to alleviate the condition. It should be noted, however, that on the basis of observations at the University of Alberta, pigs turned out to pasture in sunny weather may make extremely poor gains for 2 to 3 weeks. Colored pigs do not appear to sunscauld as readily as white pigs but in a 1958 experiment no difference in gain or feed efficiency was noted between red or white pigs on pasture.

Where alfalfa-grass mixtures can be grown, they are undoubtedly the peer among perennial swine pastures, making an early start in the spring and providing a bulk of forage throughout the season. Rape has stood next to alfalfa in our experiments. While it does not provide pasture as early as alfalfa, it has a wonderful carrying capacity under Edmonton conditions and maintains a growth until late in the season. Rape is not a good pasture for young pigs as it causes irritation to their skin. Good results have been secured from many different crops tried experimentally. Annual pastures allow a better system of rotation than permanent pastures, but both have a place. The crops selected will depend upon local conditions, and the choice of a crop is really secondary to making provision for green forage for breeding stock.

Carrying capacity of pastures varies tremendously with the region, season and type of pasture. A general recommendation is that an acre of pasture is sufficient for 15 to 20 finishing hogs or 3 to 5 sows with litters. Pasture lots should not exceed from one-



Fig. 16.—Brood sows should have access to good pasture during the summer months. The above illustration shows a few of the sows at the University Farm on their summer pasture.

half acre to one acre in size, and where a larger area is required, cross fencing is strongly recommended.

A Balanced Ration

In the discussion which follows it is assumed that the majority of swine feeders will be using a mixed supplement or “hog concentrate” containing 35 to 40% of protein and recommendations will be based upon this assumption. The term “supplement” will be used in this connection. Generally speaking, 15% supplement should be added to the grain for young pigs and 8% for pigs over 110 lb. in weight. See page 45 for more details.

A balanced ration is one that supplies all of the nutrients required by an animal at the optimum levels to bring about the best and most economical production. While the addition of one or other of protein or mineral to a mixture of farm grains will bring about improvement in the performance of growing pigs, it requires both to balance the ration properly and insure best results. This is indicated by the results of a series of experiments conducted several years ago at the University of Alberta. One group of pigs was fed on grain alone, one had ground limestone added to grain, and a third had both protein and mineral added. The pigs were fed inside the piggery; 1% of salt and 1% of cod liver oil were added to the feed mixture in all lots. The results are shown in the following table.

TABLE XVIII.—PROTEIN AND MINERAL ADDED TO GRAIN

	LOT I Grain Alone	LOT II Grain, Mineral	LOT III Grain, Mineral, Protein
Average initial wt. lb.	51	50	50
Average final wt. lb.	139	167	201
Average daily gain lb.	0.69	0.92	1.27
Av. daily feed lb.	3.64	4.35	4.75
Feed req'd. for 100 lb. gain lb.	525	472	373

It will be noted that the addition of mineral alone contributed to improvement, but more feed was eaten per day, the average daily gain was increased and the feed requirement for 100 lb. gain was lowered when both protein and mineral were fed. Improvements in ration formulation, particularly the use of antibiotic feed supplements, have further improved this picture.

Inside pig production makes it necessary to study carefully the proper addition of supplements to the farm-grown grains. If the protein, mineral and vitamin requirements of pigs are not taken care of under such a system, disappointing results are sure to follow.

Preparation of Feeds

Cooking

Experimental work and private experience have shown that cooking decreases the digestibility of most feeds, and adds to the cost of production. On the basis of 3 experiments, when cooked grain was compared with dry grain fed from a self-feeder, we concluded that the expense of cooking the grain is not warranted. Such feeds as potatoes are better cooked, and garbage must be cooked to eliminate the hazard of disease. When economy is not an object, such as in fitting for show, the palatability of feeds may be improved by cooking.

Soaking

Soaking grain does not seem to be good practice, as even when whole grain is soaked feeding value is not improved. In an experiment conducted during the winter of 1931-32 at the University of Alberta, pigs fed whole dry grain (oats and barley) gained 29% faster and required 10% less grain for 100 lb. of gain, than those fed the same mixture after soaking. New methods of water treatment and drying of barley, which have been reported to improve efficiency, are not economical for practical production.

Grinding

We are asked from time to time whether or not it pays to grind grain for pigs. Related to this question is one concerning the degree of fineness to which the grain should be ground. Efficiency of feed utilization was reduced an average of 9% by feeding whole barley as compared to ground barley in three experiments at the University of Alberta during 1955-56. Based on these and earlier experiments, it would appear that moderately fine grinding is to be recommended with barley and oats if such a treatment can be given at moderate cost. Wheat should not be too finely ground for pigs; a rather sharp gritty texture is best.

Pelleting

Studies during 1954 to 1956 with pelleted creep feed rations and with pelleted supplements fed free-choice have shown no effect on palatability, rate of gain or feed efficiency due to pelleting as compared to normal grinding of these feeds. Pelleting will reduce dustiness and may reduce wastage and with some feeds may be desirable if it can be done at a reasonable cost. Many aspects of the effects of pelleting on the chemical and physical properties of feeds have yet to be explored.

Methods of Feeding

There are 2 methods of pig feeding commonly practised: (1) the hand-feeding method, feeding the ration either wet or dry twice or three times daily, and (2) the self-feeding method, where the self-feeder is used and feed is kept before the pigs at all times.

The method to be recommended will depend upon the number of pigs to be fed, the amount of grain on hand, the rate of gain desired, and the amount of labor available. The relative merits of the two systems have been extensively studied experimentally, for example in a series of experiments conducted at the University of Alberta during 1946 and 1949-50. Self-feeding did not cause any large or consistent difference in rate of gain, feed required per 100 lb. gain, or cost per 100 lb. gain when compared to full hand-feeding. Under practical conditions pigs are often not full-fed when they are hand-fed and under such conditions self-feeding would undoubtedly increase the rate of gain.



Fig. 17.—Pigs at self-feeders. Note the one-way self-feeder together with a two-way self-feeder.

The number of grade A carcasses yielded was similar in both the hand-fed and self-fed groups. More detailed scoring by Advanced Registry methods suggests that, if the breeding stock in use is just borderline for length and backfat thickness, self-feeding may result in a reduction in the percentage of Grade A carcasses. The experiments indicate that a good deal of labor and often drudgery can be saved by the use of properly constructed self-feeders, and that, if the breeding stock is of the right type, self-feeding can be practised without serious reduction in carcass quality.

In a 1958 experiment pigs were fed a balanced ration once a day, twice a day or by self-feeder. Restricted feeding resulted in slower gains on one hand and improved feed efficiency and superior carcasses on the other. Whether restricted feeding to the extent of twice a day feeding would be practical would depend on the general level of carcass merit of the strain being fed, and the relative cost of feed as compared to labor and capital.

A third method of feeding is widely followed in the midwestern United States and has been studied extensively during 1955-56 at the University of Alberta. This is free-choice feeding of grain and a complete supplement in separate feeders to avoid the cost of mixing. It appears that free-choice feeding of ground barley or barley and oats with supplement may result in slower gains than are obtained from a mixed ration, but that feed efficiency will be similar under either method of feeding. A palatable supplement based on soybean oil meal and containing about 40% total protein is desirable for best results in free-choice feeding.

Water

A source of clean water should be available to pigs at all times, preferably by automatic waterers, and it should be kept ice-free in winter. A concrete platform is advisable to prevent formation of a mud wallow. A pig requires about 2.5 lb. of liquid for each pound of solid feed. One automatic waterer, example illustrated in figure 27, will supply 20 to 30 sows or 30 market pigs. Young suckling pigs should have a source of water in their creep area.

Water high in mineral content may prove harmful to pigs and such water should be analyzed for salt content. In experiments at the University of Alberta, however, pigs from weaning to market were not harmed by drinking water containing 5,000 p.p.m. of common salt, Glauber's salts or Epsom salts. Source of water supply should always be considered when a problem arises that is not readily diagnosed.

FEEDING AND MANAGEMENT OF BREEDING STOCK

Breeding stock can be selected most satisfactorily when pigs are around 200 lb. in weight as at that time it is possible to observe the animals in market condition. Adequate records (see page 17) must be kept so that individual pigs are identified, as intelligent selection must be based on performance (see page 21).

Sows

Having secured the right brood sow much of the year's success in pig raising depends on how she is fed and handled prior to breeding and during the pregnancy period. Sows which are bred in good condition and are well nourished during the pregnancy period are much more likely to farrow big strong litters than sows which are thin and run-down when bred and poorly cared for during pregnancy.

The raising of two litters per year by the sows, would tend to equalize the marketings and in addition would lower the cost of production. The cost of carrying a sow for the year is very little greater when she farrows twice than when she farrows only once. On the average a sow requires 2500 to 3000 lb. of feed per year.

It must be borne in mind, of course, that when sows farrow during the late fall or winter months, better than average farrowing quarters must be available. Provision will have to be made for artificial heating (see page 56), care must be taken to avoid chilling of the young pigs at birth and during the suckling period, and strict precautions will have to be taken to guard against the development of anemia in the young pigs (see page 59).

Pigs farrowed during the late fall or early winter months may cost more to produce but on the basis of the usual price prevailing on an open market they will bring a higher price than those farrowed in the spring and marketed during the fall months. In the University of Alberta herd for the 15 years from 1935 to 1949 it took an average of only 3 days more per pig to market fall pigs compared to spring pigs. Eight pigs per litter were weaned from the fall litters compared to 7.6 pigs per litter from the spring litters.

Feeds for Breeding Stock

Following selection at market weight of gilts and boars for breeding stock, they should be transferred from a finishing ration to a gilt ration as outlined in the following section (for boars see page 56).

Sows should be flushed by placing on full feed from one week before breeding until 3 weeks after breeding. Then reduce feed to 4-6 lb. per day or 2-3 lb. per day if on pasture and increase to

6-8 lb. about one month prior to farrowing. Mature sows should gain about 75 lb. during pregnancy and gilts should gain 100-125 lb. in this period. Higher feeding levels should be practiced if a sow is quite thin when her litter is weaned.

Grains

Farm-grown grains may form the basis for suitable rations for breeding stock. Mixtures containing about 50% oats have been used satisfactorily at the University of Alberta. Barley and wheat alone are too fattening for sows or boars, and may tend to cause weak pigs and a lack of milk in sows at farrowing time.

Grains may be fed ground and either slopped or dry. Self-feeding may be practised but a bulky ration should be used. If sows become too fat on self-feeding, they should be changed to hand-feeding and their feed intake limited.



Fig. 18.—Gilts on good summer pasture. To develop properly they must also receive adequate grain and supplement.

Supplements

Feed 10-12% sow concentrate to sows and 15% concentrate to gilts. If excellent pasture is available the amount of feed should be restricted but it is advisable to maintain the same level of supplement. In winter, ground alfalfa or alfalfa-grass hay should be mixed with the grain at the rate of from 10 to 30%, and if the alfalfa cannot be ground and fed in this way it may be placed in feed racks or fed on the ground. If alfalfa is not available some other hay may be substituted or even green oat sheaves will be helpful. With young sows which will farrow their first litter, such foods as skimmilk or buttermilk are useful and may be used to reduce other supplements required. One pound of bran added to the feed daily for two or three weeks before and for several days after farrowing will exercise a laxative influence.

If skimmilk or other protein supplement is being used instead of a complete "concentrate", the feeding of iodized salt, limestone



Fig. 19.—Yorkshire sow with litter of 12 pigs at the University of Alberta. The pregnant and nursing sow should be liberally fed to stimulate milk production.

(see page 41) and a vitamin A and D supplement to pregnant sows is strongly recommended.

Hairless Pigs—Goiter

The thyroid gland of any animal is necessary to maintain life and its function is dependent upon a supply of iodine. The amount of iodine required is very small, but in many localities in Alberta there is a lack of iodine in the soil, so iodine must be supplied, or iodine deficiency and goiter will result. Little pigs, as a result of iodine deficiency, are born without hair, have a puffy skin and usually are thick around the neck. They are often dead at birth, or die within a day or two.

The disease is easily prevented by supplying iodine in sufficient amounts to the pregnant sow, usually in the form of iodized salt. If iodized salt does not prove adequate, dissolve one ounce of potassium iodide in a gallon of water and give one tablespoon of this solution daily in the feed. The solution must be kept in a glass or enamelware container.

Vitamin A Deficiency

Frequently in the winter and early spring, weak litters, sometimes partially blind or suffering from convulsions, may be born. These conditions are often due to a vitamin A deficiency. Therefore, for sows not on pasture, care must be taken to supply adequate vitamin A (see page 42).



Fig. 20.—A colony house banked with straw provides good shelter for wintering pregnant sows. For sows $12' \times 8'$ or $12' \times 10'$ houses are preferable to smaller colony houses.

Exercise

Sows should be required to take a reasonable amount of exercise. Therefore it is a good plan to arrange to have the sows' shelter at some distance from the place where they are fed so that they may be forced to walk a considerable distance for feed. With regard to shelter, the main requirements are a dry bed and freedom from draughts and overcrowding. At the University of Alberta brood sows are always wintered in banked colony houses of the type illustrated above.

Balanced Rations for Sows

The importance of balanced rations for brood sows is indicated by the results of an experiment which was conducted at the University of Alberta prior to 1949. Sows denied access to pasture and fed continuously on a mixture of 98 lb. equal parts oats and barley plus a pound of ground limestone and a pound of iodized salt weaned an average of only 4.6 pigs per litter as compared to an average of 8.2 for sows fed the same grain supplemented with minerals, feeding oil, protein and pasture in season. Due to the added expense involved in providing pasture as well as protein, mineral and vitamin supplements for the sows of the latter group, the cost of maintaining these sows was somewhat more than one and a half times the cost of maintaining the group that weaned only

4.6 pigs per litter. However, the net return from the well-fed sows over a 3½ year period was four times that realized from an equal number of sows fed the unbalanced ration.

Boars

The boar on many farms is apt to be a neglected animal. The ideal treatment of the boar is practically identical with that of sows of a similar age, and suggestions made for feeding the sow should also be applied to the boar. During the breeding season the boar's allowance should be increased and as palatable feeds as possible fed, as many boars are apt to go off feed at that time.

A few special comments on management of the boar are in order. He should be housed outside in a colony house with pasture for the summer season and should be provided with plenty of exercise to keep him in good breeding condition. He should have the company of sows in an adjoining pen to help in keeping him from becoming bad tempered. Young boars should not be used for breeding until they are from 8 to 9 months of age, and not used too extensively during the first season. It is a mistake to allow a young boar to run with the sows and breed indiscriminately. Mature boars should have their tusks removed to increase safety in their handling.

Care at Farrowing Time

Farrowing time is the critical time in the pig business. It is estimated that 20 or 30% of the pigs farrowed are lost between farrowing and weaning time. A pig which dies at farrowing may not appear to represent a heavy loss, but it may represent the difference between profit and loss from a litter.

The following farrowing time precautions are suggested:

(1) Provide warm (50-60°) farrowing accommodation for sows (see page 76). Additional heat for the young pigs must be provided in the form of a "brooder house", a heat lamp with a 250-watt infra-red bulb placed in a partitioned-off corner of the farrowing pen, or radiant heat in the floor of the creep area. Farrowing stalls provide warmth and reduce overlaying of the pigs.

Farrowing in unheated colony houses has proven successful at the University Livestock Farm in the summer months, but such a system does not lend itself to year around production.

(2) Remove the sow from her winter shelter or summer pasture to a suitable farrowing pen at least one week before she is due to farrow. The length of the pregnancy period in the sow is from 112 to 115 days, or 3 months, 3 weeks, 3 days (see gestation table for brood sows on back page of bulletin).

(3) Properly clean and disinfect the farrowing pen before the sow is placed in it. It is recommended that the floors be scrubbed

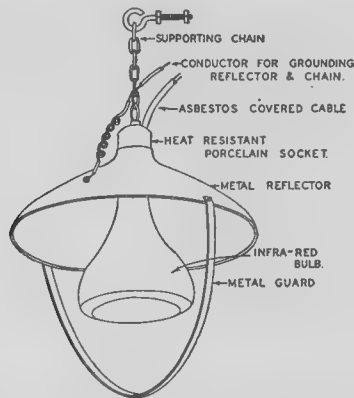


Fig. 21.—Infra-red heat lamp for pig brooding showing installation to comply with the Rural Wiring Regulations of the Province of Alberta.

with a strong solution of lye in **boiling** water (1 lb. of lye to 30 gallons of water). This destroys worm eggs and prevents the little pigs becoming infested with round worms while in the farrowing pen.

(4) If weather permits, thoroughly wash the udder and preferably the entire sow.

(5) Provide a guard rail around the side of the farrowing pen. This rail, which may be a 2" $\times$ 4", or a pipe, should be placed approximately 8 inches from the floor and project out 8 inches from the wall. This guard rail allows the small pigs to seek protection when the sow lies down, and is a worthwhile means of avoiding loss by crushing.

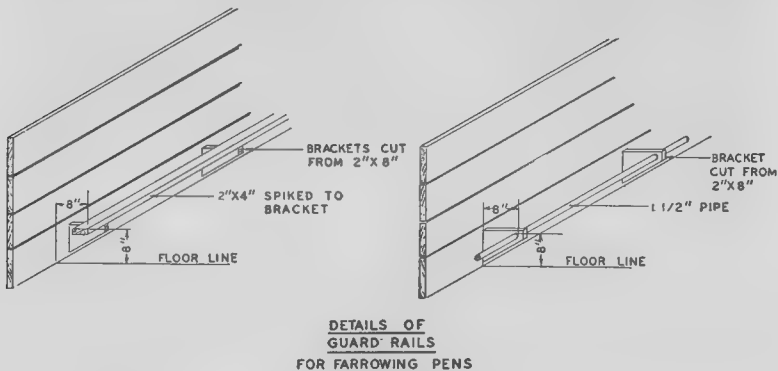


Fig. 22.—Details of farrowing pen guard rails to prevent the sow from crushing the young pigs.

(6) Avoid long coarse straw in the farrowing pen. The newly-born pigs may become either tangled or buried in the long straw, and thus are more likely to be crushed. Cut straw or shavings in limited quantities makes the most suitable bedding for the farrowing pen.

(7) Be present when a sow is farrowing. If the small pigs have become chilled they may be revived by placing them in a box near the stove, or individual pigs may be wrapped in a warm blanket or immersed up to the neck in warm water. When the sow is irritable or clumsy, it is a good plan to remove each pig as it is born and return the complete litter for nursing when farrowing has been completed and the sow is resting quietly.

(8) Remove the small tusks, or "black teeth" as they are commonly called, from the mouths of the small pigs within a few hours after they are born. These sharp teeth irritate the sow's udder and cause cuts and scratches on the faces of the pigs while fighting at nursing time. The job can be done with sharp small nippers made for the purpose. Care should be taken to avoid cutting the gum, and to avoid jagged edges on the cut tooth. (See figure 23.)



Fig. 23.—Removal of the small tusks or "black teeth" shortly after a pig is born.

(9) Failure of the sow to milk is frequently brought about by faulty management and inadequate feeding during pregnancy. Be sure sows get adequate exercise. Feed throughout the entire pregnancy period well balanced rations containing plentiful protein, minerals and vitamins as discussed earlier. A light, laxative feed will sometimes bring about milk flow in a sow which fails to start milking. Even with adequate rations and good management an

occasional sow may not milk, and in such a case milk flow can sometimes be initiated by the use of hormones and calcium preparations administered by a Veterinarian. A fever (temperature above 102° F.) lasting for several hours will stop milk flow, and treatment with 1.5 to 3 million I.U. penicillin may be helpful.

Feed and Care of Sow and Litter

Sows should not be fed heavily following farrowing but should be allowed lukewarm water. If they are not sick they should be allowed feed as soon as they wish to eat, which is usually inside of 12 hours. The first feeds given should contain a high percentage of such feeds as bran, shorts and oats. The feed may be gradually increased and heavier feeds added until the sow is on full feed in about a week. Sows at the University Farm normally eat 14 to 18 lb. of feed per day during the major part of lactation.

When skimmilk or buttermilk is not available, the addition of 12 lb. sow concentrate to each 100 lb. of grain is to be recommended. In the case of gilts, 15% supplement is advisable. A mixture of 50% oats with barley and/or wheat may be used satisfactorily as the grain mixture.

Care of the Litter Before Weaning

Prevention of Anemia

Anemia of suckling pigs occurs as a result of a deficiency of iron and to some extent, copper. Iron constitutes an important part of the blood, and without it the blood is unable to carry out its proper function of supplying the body with food and oxygen. Anemia of little pigs is the cause of substantial losses annually.

Iron is present in the soil, and animals that are on pasture receive sufficient amounts. Sow's milk contains little iron, and from birth until they begin to eat regularly, pigs raised inside have a deficient supply of available iron.

The anemia is usually apparent within a week after birth. In white breeds the skin is noticeably pale, the hair is dull and lacks luster and sheen. The ears which are normally pink become white. The little pigs may show listlessness and lack of playful energy observed in healthy litters. In severe cases there is evidence of rapid or labored breathing, a condition sometimes termed "thumps", possibly followed by death.

Anemia is preventable by supplying available iron to little pigs for the period from birth until they begin to eat. There are several methods by which this may be accomplished, but it is important that only recognized preparations be used.

Iron may be supplied to the pigs individually in the form of "reduced iron". The dose is estimated at being an amount which

would cover half a ten-cent piece. Studies at the University of Alberta in 1948 and again in 1954 indicated that pigs should be given the first dose when they are three days old, and the dose repeated at twice weekly intervals for three weeks or until they are eating regularly. Adding a little fish oil with the iron by means of an oil-can prevents the possibility of the dry reduced iron going down into the lungs.

Commercial preparations are available in which iron is incorporated with copper. These preparations are used in a similar manner to reduced iron.

Iron dextran and other iron carbohydrate complexes may be injected intramuscularly at 3 days of age. A dosage containing 150 mg. or more of iron is recommended. Recent studies at the University of Alberta indicated a similar response from an injected iron dextran complex and oral reduced iron. The use of reduced iron and similar oral preparations as compared to an injected iron dextran complex should be based on a comparison of cost of product versus cost of labor and frequency of treatment.

Creep Feeding

The small pigs will begin to eat solid feed by the time they are 3 weeks of age. This should be encouraged as the sow has passed her maximum milk production at this stage and cannot supply pigs

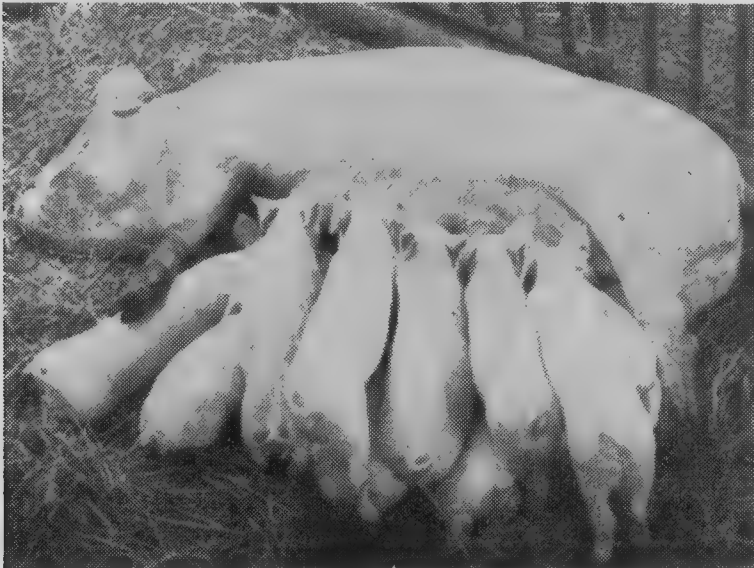


Fig. 24.—A thrifty litter at the University Farm. Creep feeding is necessary as a supplement to the sow's milk to wean heavy litters.

with all the nutrients they need. The young pigs should be provided with a separate small self-feeder (see figure 25), as a hungry sow may throw the small pigs against the edge of the trough or the wall and injure or even kill them. In addition, the sow's feed is usually not satisfactory for young pigs and they should have their own "creep" ration. A creep ration may be placed in a partitioned corner of the pen and the small pigs may help themselves as they please. Water must be available for the suckling pigs at all times if they are to make the best use of creep feed rations. For pigs that are weaned early or if disease is a problem in a piggery, a soluble antibiotic supplement should be added to the water for several days before and after weaning.

There are commercial fortified pig starting rations available which may be used to good advantage at this stage. If a producer has adequate mixing facilities, the following creep feed mixture which has been used successfully at the University Livestock Farm in recent years can be mixed:

Wheat	68
Common sugar	10
Soybean oil meal	15.5
Fish meal	5
Iodized salt	0.5
Ground limestone	0.6
Antibiotic feed supplement (to supply 25 - 50 gm. antibiotic/ton) approx.	0.4
	100 lb.

Vitamin A and D supplements to supply 100,000 I.U. and 20,000 I.U. respectively of vitamin A and D per 100 lb. ration. B-complex vitamin supplement to supply riboflavin, niacin, pantothenic acid and vitamin B₁₂.

We have observed that pigs weaned at 8 weeks of age will normally eat about 20 lb. each of this creep ration prior to weaning. Based on 1955-56 experiments, this quantity of creep feed ration will result in an extra 10 lb. of weight at weaning time, so that a relatively complex expensive ration is justified.

A few comments on creep feed rations are in order. They must be palatable, and that is the reason for the addition of 10% sugar. They should be high in energy and, in this regard, our experiments in 1954 indicated that wheat is equal to oat groats. Fortification with necessary protein, minerals, vitamins and an antibiotic supplement is another prerequisite. A less complex creep ration consisting mainly of oat groats is useful if nothing else is available, but will not give results equal to a balanced ration.

Care must be taken not to use whole oats as small pigs cannot digest the coarse hulls, and in addition, the sharp hulls may cause digestive troubles. If all of the ingredients are finely ground, the use of pelleted creep feeds may encourage early consumption of the feed by the suckling pigs, although pelleting did not prove beneficial in experiments at the University of Alberta. If skimmilk is avail-

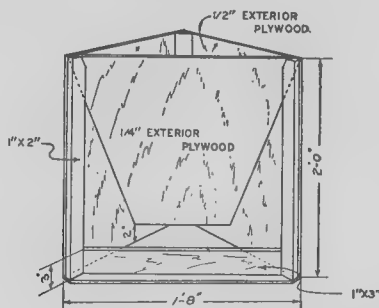


Fig. 25.—Self-feeder to be used in creep feeding.

able it should replace water for the young pigs, in which case the protein supplement may be reduced in the creep feed.

Early Weaning: Orphan Pigs

Milk replacer products are available and may be used successfully in raising orphan pigs if a program of extreme sanitation is followed, and if the pigs get the first milk or colostrum from the sow. It seems unlikely that extremely early weaning prior to 3 weeks of age has a place in Western Canada at present, so the use of these products will be limited largely to raising orphan pigs or extra pigs from large litters. Orphan pigs are very subject to ailments, and unless a producer is willing to spend considerable time, it frequently does not pay to raise them.

Pigs may be successfully weaned at 3 weeks of age or at over 10 lb. in weight by using a prestarter ration similar to the creep feed ration shown on page 61, or by using commercial prestarter rations. In 1955-56 experiments at the University, early weaned pigs averaged 35.4 lb. at 8 weeks compared to 38.3 lb. for pigs weaned at 8 weeks. A cost evaluation indicated that 3-week weaning resulted in cheaper production.

Despite this, early weaning cannot be recommended under practical conditions without reservation. Occasional litters may not respond to early weaning, particularly large litters where pigs average under 10 lb. weight at 3 weeks. If disease or other stress factors are present, early weaned pigs may be less able to cope with such adverse conditions. Quality of labor and management is more critical where pigs are weaned early. Early weaning, however, does appear to be another step toward greater efficiency in hog production where management and facilities are very good. Unless a producer makes use of early weaning to get more litters from his sows it offers no advantage over normal weaning.

Castration

Male pigs intended for slaughter should be castrated by six weeks of age. Many farmers hesitate to castrate pigs, but the operation can be safely done if a few simple precautions are observed. Cleanliness, a sharp knife, a fairly generous incision coming well down on the scrotum to permit drainage, and a disinfectant in the wound are the main precautions. Do not castrate within one week of weaning.

FEEDING, MANAGEMENT AND HOUSING AFTER WEANING

Growing Pigs

Pigs should be weaned at 8 weeks of age. Earlier weaning may be practised as discussed on page 62.

The weanling stage is the critical period in the pig's life, and a special effort must be made to carry the young pigs over from the mother's milk period of his existence to a point where his digestive organs become accustomed to large amounts of solid food. If a sudden change is made to a feed mixture which is very coarse in texture or is seriously lacking in the essentials mentioned, digestive disturbances are apt to develop, resistance to infection will be lowered and serious losses may follow. (See page 61 re antibiotics in water.)

If the pigs have been well acquainted with a good combination of feeds before weaning by the use of a "creep", the chances of a weaning set-back will be avoided to a large extent.

A satisfactory feeding program can be worked out by purchasing a commercial starter and then mixing growing and finishing rations using home-grown grains and purchased concentrate. Water should be available at all times, as insufficient water will lower gains.

Grains

Wheat and barley are satisfactory as the basis of a ration for weanling pigs. Since the small pigs cannot handle much bulk, oats should be restricted to 25% of the ration. Oats and barley should be ground fairly finely for weanling pigs but wheat should be left in rather a sharp gritty state.

Protein Supplements

Skimmilk and fresh buttermilk are good substitutes for the mother's milk, but when these are not available, a commercial concentrate will serve as a good replacement for milk at this stage.

The supplement may be mixed with the grain at a rate of 15 lb. in 100 lb. of feed mixture and kept at this level until the pigs reach



Fig. 26.—A typical pig suffering from enteritis such as might be caused by high fiber rations as well as other nutritional and non-nutritional causes. Diarrhea is an accompanying symptom.

a weight of around 110 lb. when it should be reduced to 8% (see page 45 for further details).

To indicate the advantage of using some form of substitute when milk is not available, Table XIX is presented. Three groups of pigs were included in an experiment during the winter of 1939-40 and checked through the after-weaning stage, one group getting grain alone, one tankage as a milk substitute and one skimmilk. A mixed protein supplement would probably have given results comparable to those obtained with skimmilk. (See page 37.)

TABLE XIX.—SUPPLEMENTS FOR PIGS AFTER WEANING

	GROUP 1 Grain Alone	GROUP 2 Grain Tankage	GROUP 3 Grain Skimmilk
Number of pigs	8	8	8
Average daily gain during 6 weeks after weaning lb.	0.34	0.67	1.01

Mineral, Vitamin and Antibiotic Supplements

If weanling pigs are receiving a "hog concentrate" as suggested, it should not be necessary to feed mineral or vitamin mixtures. There is, of course, no harm in self-feeding some simple mineral mixture (see page 42) at the weanling stage. Zinc (see page 41) should be in all rations at this stage to prevent parakeratosis.

If the pigs are weaned during the late fall, winter or early spring months, or if they are confined to the piggery, it is necessary to feed them some source of vitamin A and D up to at least 100 lb. in weight.

Animals to be saved for breeding stock should receive a vitamin A and D supplement continuously.

Vitamin B₁₂-antibiotic feed supplements or antibiotic supplements are usually very useful in promoting increased rate of gain in weanling pigs. Details of the proper use of antibiotic supplements are given on page 43.

Method of Feeding

The system of feeding to be followed will depend upon the factors which were discussed on page 50. A system of self-feeding is being followed very satisfactorily under our method of management at the University Livestock Farm and we are inclined to recommend this method when any large number of pigs is to be raised. The number of pigs per self-feeder hole or per linear foot of self-feeder should not exceed 6.

For hand-feeding, the length of the trough per pig should be 8 to 10 inches.

For pen area allow 6 sq. ft. per pig to 100 lb. and 10 sq. ft. per pig to market (see page 71). Do not group pigs that vary widely in weight. If a pig shows signs of unthriftiness remove it to a hospital pen. Crowding of pigs, along with an unbalanced ration, often contributes to tail chewing and cannibalism in pigs.

Worm Treatment

Shortly after weaning it is advisable to treat pigs for intestinal round worms (ascarids) which are prevalent in Alberta hogs. One or two months before farrowing the sow may be treated for worms.

For control to be logical it is necessary to know something of the life history of the parasite. The adults in the intestine lay numerous eggs which pass out with the manure, contaminating the soil, feed utensils and pastures. These eggs or ova are swallowed by animals with their feed, and hatch into larval worms which, before becoming established as adult worms in the intestine, migrate through the lungs and liver, causing extensive damage which may result in coughing and pneumonia.

The adult worm living in the intestinal tract causes irritation and damage to the intestinal wall, resulting in enteritis and unthriftiness, and rendering the animal more susceptible to diarrhea.

Well fed, healthy swine sometimes carry heavy worm infestation without showing any marked disturbances, a fact which again points to the advisability of proper feeding and management in disease prevention. A study of the life history of the worm makes it easily understandable why sanitation is so necessary in the control of this parasite. To prevent recontamination, practices outlined on page 57 should be followed.

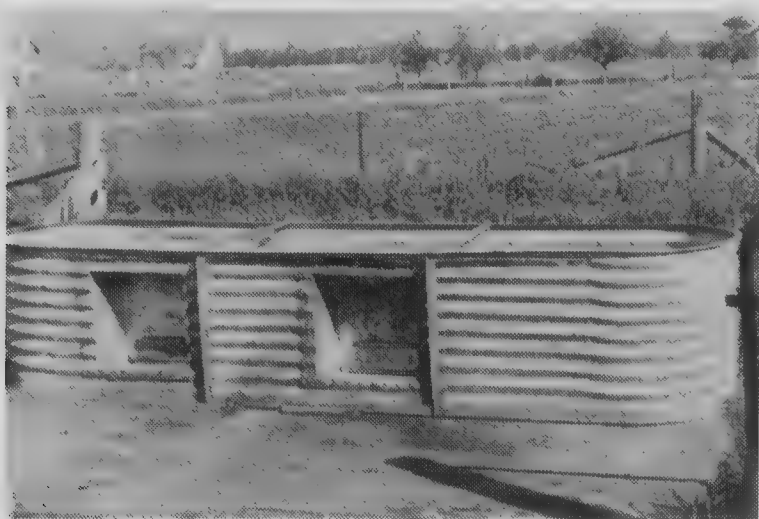


Fig. 27.—An automatic waterer reduces labor and keeps water in front of pigs during the summer months.

There are several methods of treatment.

1. *Sodium Fluoride*—Weigh the amount of grain or chop that is fed to the pigs in one day. To this is added one per cent by weight of sodium fluoride. Care should be taken to mix it thoroughly and it must be fed dry. Pigs may be given water to drink between meals. Care must be taken in measuring the sodium fluoride for it is toxic, and poisoning may occur.

2. *Cadmium oxide compounds*—Commercial preparations containing cadmium oxide are available for worm treatment and as they are much less toxic than sodium fluoride they are safer to use. Directions for use will be found on the container.

3. *Hygromycin*—This is an antibiotic which may be fed in the growing period and which offers a method of ascarid control.

4. *Piperazine derivatives*—These seem to offer the best worm control of products now available.

New worm remedies are becoming available at frequent intervals so that it is advisable to check on recent advances in this field. An individual producer should use an effective control method which is least costly under his conditions.

Finishing Feeder Pigs

A finishing pig is past the most critical stage of its life but proper feeding and management cannot be ignored. Pigs of this age are still subject to diseases and parasites. It is important that pigs

are properly finished and marketed at weights of 190 to 210 lb. on the farm, so as to yield carcasses of 140 to 170 lb. in weight with 140 to 150 lb. being the preferred weight. Pigs which are underfinished are objectionable as they yield flabby undesirable carcasses. Overfinish, which is more common, results in excess waste fat and lower grades.



Fig. 28.—Spring farrowed pigs may make good use of pasture as a supplement to grain rations during the summer months.

Rations

Grain mixtures suggested for finishing pigs are as follows:

Oats 1 part		Oats 2 parts		Wheat 1 part
Barley 3 parts	or	Wheat 3 parts	or	Oats 1 part
				Barley 2 parts

A supplement should be fed at the rate of about 8% of the ration. As pointed out on page 34, finishing rations high in oats or diluted with other fibrous feeds do tend to yield high quality carcasses. Results of a trial conducted in 1955-56 indicated that 10% or 25% alfalfa meal or 25% ground good quality hay in the finishing ration all produced high grading carcasses. If efficiency of feed utilization and cost of production are to be maintained reasonably well, not over 10% of these latter diluents should be added to the ration.

Suitable Rations for Winter Pigs

Unless the ration of winter pigs is well balanced, gains are likely to be slow and comparatively expensive. Pigs badly fed during the winter months can "pile up a heavy feed bill" and prove a liability rather than an asset.

Feeding practices discussed on pages 36 to 46 apply particularly to winter pigs. A constant supply of water at above freezing temperatures must not be neglected. An experiment at the University of Alberta indicated that there was no advantage to warming water

for pigs, so all that is necessary is to be sure that the water does not freeze.

Feed to Proper Market Weight

In order to indicate the rate of gain which may be expected during the finishing period and at the same time suggest the advantage in economy in avoiding overfinish, the following tables showing the results of an experiment conducted in 1953-54 are presented.

It will be seen in Table XX that while the three groups of pigs made very good gains, the pigs which were fed until they averaged 225 lb. in weight yielded no grade A carcasses mainly because they were over the 170 lb. weight limit and because they were too fat to meet the grade A requirements. In the case of the pigs marketed at 180 lb., several carcasses were under the required grade A weight minimum of 140 lb., although in other respects they were very desirable. Many of the grade B₁ hogs marketed in Alberta would grade A if they had been marketed 10 to 20 lb. lighter in liveweight.

TABLE XX.—RATE OF GAIN AND GRADE OF PIGS MARKETING AT DIFFERENT WEIGHTS

	Average market weight, lb.		
	180	205	225
No. of pigs in lot	8	8	8
Av. daily gain lb.	1.31	1.42	1.42
Av. hot carcass wt. lb.	141	159	177
Carcass grades:			
A	4	3	...
B-1	4	4	2
B-3	...	...	6
C	...	1	...
Average fat:			
Shoulder	1.9	2.0	2.2
Back	0.9	1.1	1.2
Loin	1.3	1.6	1.7

TABLE XXI.—SUMMARY OF RATE OF GAIN, FEED CONSUMPTION AND FEED EFFICIENCY OBTAINED DURING DIFFERENT STAGES OF GROWTH

Weight range lb.	Av. daily gain	Av. daily feed	Feed required per 100 lb. gain
	lb.	lb.	lb.
50-75	1.12	4.0	361
75-110	1.35	5.4	396
110-150	1.48	6.5	439
150-185	1.47	6.6	446
185-205	1.51	6.8	450
205-225	1.58	7.5	475

Table XXI summarizes the gain, feed consumption and feed efficiency of the pigs in this experiment. As a pig becomes heavier it requires more feed to make a pound of gain even though it tends to gain faster. This experiment, together with an experiment conducted in 1939, indicates that the largest net returns on pigs will be received if they are marketed at around 200 lb. and not over 210 lb. liveweight.

Summary of Feeding Suggestions

The major nutrient requirements of swine on the basis of percentage of the feed are summarized in Table XXII.

TABLE XXII.—NUTRIENT REQUIREMENTS OF SWINE ON THE BASIS OF PERCENTAGE OF THE FEED

Type of Ration		Creep- pre- starter	May be combined			Sows	
			Starter	Grower	Finisher	Preg- nancy*	Lac- tation
Weight of pigs	lb.	10-40	40-75	75-110	110-200		
Expected daily gain	lb.	0.8	1.4	1.6	1.8		
Av. daily feed consumption, lb.		(0.5 creep 1.6 weaned)	3.5	5.0	6.5	(1.0 gilts 0.5 sows)	6 12-18
Crude protein	%	20	16	15	13	15	15
Calcium	%	0.8	0.65	0.65	0.55	0.6	0.6
Phosphorus	%	0.6	0.45	0.45	0.33	0.4	0.4
Salt (iodized)	%	0.5	0.5	0.5	0.5	0.5	0.5
Vitamin A	I.U./lb.	500	500	500	500	1250	1250
Vitamin D	I.U./lb.	90	90	90		90	90

*Feed consumption may be restricted as much as 50% when sows are on good pasture.

In order to bring together some of the suggestions offered earlier in this bulletin, the feeding plan in Table XXIII is offered. These suggested rations meet the above requirements under average Alberta conditions, when skim milk is not available.

TABLE XXIII.—SUGGESTED RATIONS FOR SWINE

		Creep- prestarter	May be combined			Sows**	
			Starter	Grower	Finisher	Preg- nancy	Lac- tation
Barley and/or wheat	%	Complete	50-85	50-85	42-67	18-38	38-63
Oats	%	ration	0-25*	0-25	25-50*	40-50	25-50
Alfalfa meal or hay	%	recommended	0-5	0-10	0-10	10-30	
"35 to 40% Concentrate",	%	see page 61	15-18	12	8	12-15	12-15

*Oat groats may be fed at much higher levels in the starting period. Use of oats in the finishing period is discussed on page 34.

**Boars should be fed similarly to pregnant sows with an increase in feed when breeding.

VETERINARY SERVICES

It is strongly recommended to all swine producers to obtain the advice and services of a Veterinarian when sickness appears in their hogs. This is impossible in some districts of Alberta, but where such services are available it is in the producer's own interest to have professional advice.

A Veterinary Laboratory is maintained in Edmonton by the Alberta Department of Agriculture as a public service. Its facilities are available to all livestock producers in the Province, free of charge. When animals are sick or dying a specimen should be submitted to the Laboratory for examination. It is important that animals should arrive at the Laboratory as soon after death as possible. A live sick animal is preferable. If dead, the carcass should be packed in ice and sawdust, and addressed to the **Alberta Veterinary Laboratory, Department of Agriculture, 116 St. and 68 Ave., Edmonton, Alberta.**

The following pamphlets are available from the Alberta Department of Agriculture, Edmonton:

Diseases of Suckling Pigs No. 14.

Infectious Rhinitis No. 12.

Swine Erysipelas No. 116.

Swine Parasites No. 13.

Sow Breeding Record No. 59.

Feeding Orphan Pigs No. 114.

BUILDINGS AND EQUIPMENT FOR PIG RAISING

F. V. MacHardy, Department of Agricultural Engineering

Attention to the selection of functional buildings and equipment is very important to the success of a pig raising enterprise. It is important to understand that the type of program, the building requirements and the facilities for handling feed and manure are all interdependent. Time spent in planning the enterprise, gathering all available information on current building layout and design as well as on materials handling equipment will pay rich dividends.

It is impossible to cover all of these aspects in detail here. However some general information together with a list of more detailed publications will be included.

Space Requirements

The amount of building space required and the division of the space depends upon the size of the enterprise, and the pig raising program. Many farmers divide their piggeries into litter sized pens. In this program, the sow farrows in a pen and the litter remains with the sow until weaning time. At weaning time the growing pigs and the sow are separated. The growing pigs either remain in the same pen, or are removed to a feeder pen. In either case, the growing pigs then remain in that same pen until they reach market weight. Farrowing pens should be about 8 feet square, and single-litter feeder pens should provide about 12-15 square feet per feeder pig. If the feeder pens are designed to hold more than one litter, the space requirements can be reduced to 10 square feet per pig. In this system, as each litter requires a pen for six months, the number of pens required in a piggery is simply equal to the number of sows that farrow every six months, e.g.—a 6-pen piggery will allow 6 sows to farrow every 6 months. Where separate farrowing and feeder pens are used, the feeder pens should account for $\frac{3}{4}$ of the combined space.

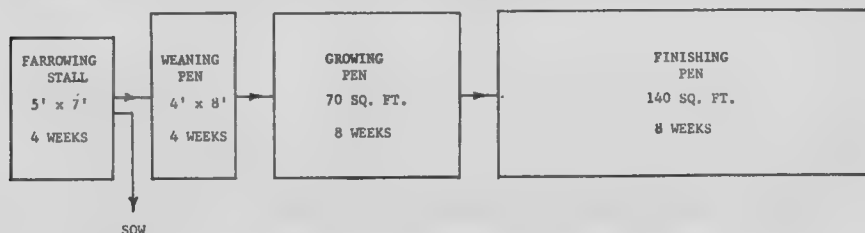


Fig. 29.—Space requirements in a confinement system of swine production.

The "confinement" system is also extensively used. In this system, the growing pigs are progressively moved through the piggery as they grow. Figure 29 shows a block diagram of this management system. It is necessary that sows should farrow at approximately regular intervals if this system is to effectively utilize the piggery space. For purpose of illustration, Figure 29 shows the space distribution required for one sow farrowing each month. Note that the farrowing stall would then normally be occupied by one sow and litter, the weaning pen would be occupied by one litter, the growing area would have two litters in it, while the finishing area would also have two litters in it. In order to determine the size of an actual piggery, it is simply necessary to multiply all of the area shown in Figure 29 by the number of sows farrowing each month. For example, if a farmer planned to farrow ten sows each month, then ten farrowing stalls would be required, together with ten weaning pens, 700 square feet of growing pens, and 1400 square feet of finishing pens.

When finishing is carried out in pens holding several litters, care should be taken to divide the sleeping quarters into compartments no larger than 12 feet square. A sleeping platform of this size is suitable for about 30 pigs.

Sleeping Platforms

Sleeping platforms should have a gentle slope towards the gutter. This slope should be about $\frac{1}{4}$ " to the foot. In addition to this slope, the area in front of the feeders and the gutters should be sloped towards drains to facilitate cleaning. A slope of $\frac{1}{4}$ " to $\frac{1}{2}$ " to the foot is satisfactory. Where it is planned to clean piggery floors with water jets, the slope of the area to be flushed should be increased to between $\frac{1}{2}$ " and 1" to the foot.

Feeders

Where self feeders are used, about 12" of opening or one feeder hole should be allowed for every 6 pigs. When hand feeding is employed, 8" to 10" of trough space should be allowed per pig. (See page 50.)

Waterers

One waterer should be provided in each pen, up to a limit of one waterer for each thirty pigs. Waterers should be located adjacent to the feed troughs. Water bowls should be located as close as possible to floor drains. In loose housing operation, electrically heated waterers may be placed outside in the paved yard.

Environment

Feeding trials have shown that feeder pigs show the highest rates of gain when the temperature is maintained at about 55 to 60° coupled with moderate relative humidities. Baby pigs can be farrowed satisfactorily in similar air temperatures providing that supplementary heat (usually in the form of heat lamps or heated floor slabs) is provided in the sleeping area. Another type of environment is provided by loose-housing barns for feeder pigs. Here, no attempt is made to control the temperature or humidity of well bedded, open front buildings.

Ventilation

The function of the ventilating system is to remove the moisture given off by the pigs. Where power-line electricity is available, fan ventilation is recommended.

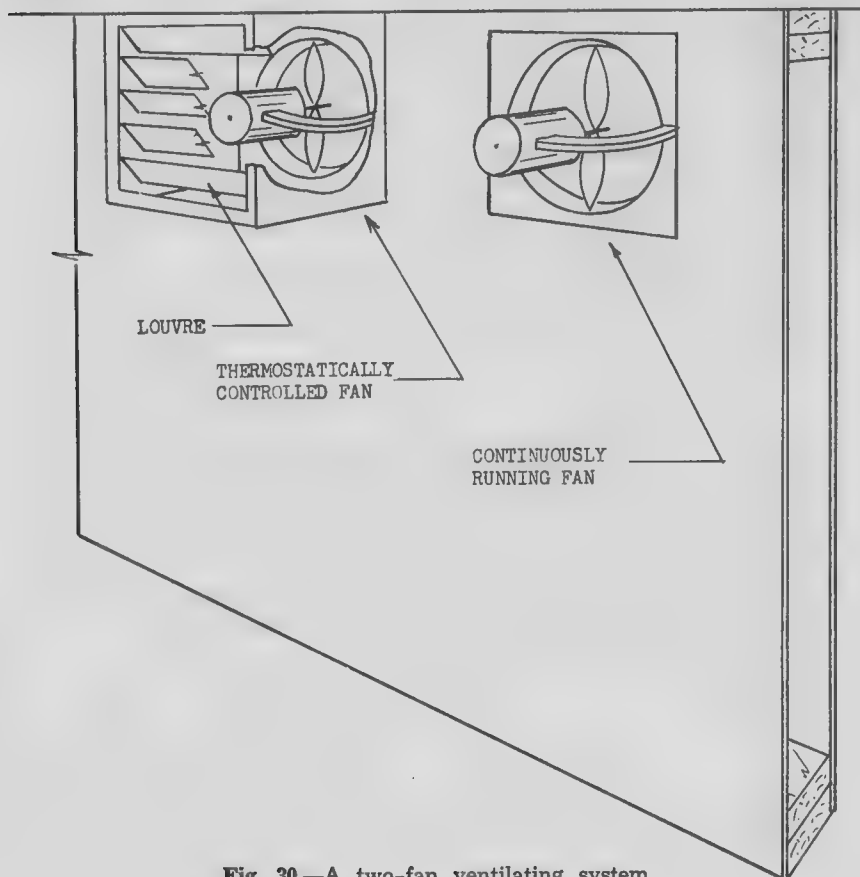


Fig. 30.—A two-fan ventilating system.

In one widely used system the warm damp air is drawn from the building and fresh air enters through small inlet openings located around the walls near ceiling level or through narrow slots from the attic space. Providing that an inside temperature of 55-60° is maintained, fans should be sized to provide the following ventilating rates:

Below 20° outside temperature	30 cfm per 1000 lb. of hogs.
20° to 40° outside temperature	70 cfm per 1000 lb. of hogs.
Above 40° outside temperature	150 cfm per 1000 lb. of hogs.

This range of ventilating rates may be obtained by equipping a single fan with a shutter or louvre, by using two fans, or by using a two-speed fan. Control may be either manual or thermostatic. In all cases some ventilation must be maintained at all times. Figure 30 shows a two-fan system. In this two-fan system, one fan runs continuously, while the other is thermostatically controlled to cut in at outside temperatures of 20 to 25°. The continuously running fan should have a capacity of 30 cfm per 1000 lb. of hogs while the thermostatically controlled fan should have a maximum capacity of 120 cfm per 1000 lb. of hogs. The louvre on this fan should be equipped with a stop which when set, prevents the shutters from opening wide. This stop should be used at all times except in warm weather, i.e., temperatures above 45°. The louvre of course closes automatically when the fan stops to prevent back drafts. The exhaust fan, or fans, should be located on the side of the piggery away from the prevailing winds.

A second system utilizes the fan to blow air into the building, while slots are provided for the exit of the air. Care should be taken in this system to blow the air over a large baffle to prevent the fans from causing local drafts.

Natural Draft Ventilation

If power-line electricity is not available, the exhaust fan may be replaced by a single out-take flue. The size of the flue should be designed for the maximum number of hogs a piggery will hold. When not full, the ventilating rate can be reduced by partially closing the control slide.

Table XXIV gives the cross-sectional area of the out-take flue.

TABLE XXIV.—FLUE AREAS NEEDED FOR VARIOUS NUMBERS OF MARKET WEIGHT HOGS

Number of 200 lb. hogs in piggery	Height in feet from floor to ridge of piggery		
	20	25	30
	Flue area (square inches)		
20	215	180	160
30	260	220	200
40	345	290	265
50	430	362	318
60	518	435	382
70	604	507	445
80	690	580	510
90	776	654	573
100	864	762	637

The out-take flue may be located at any convenient place in the building, usually in the corner of a pen. It must be well insulated, and should run straight up without any bends or offsets.

Fresh air wall inlets similar to those mentioned under Fan Ventilation must be provided.

Insulation

Where temperature in a piggery is to be controlled, insulation must be provided in the walls and ceiling in order to reduce heat losses and prevent or greatly reduce condensation on these surfaces during cold weather. Dry planer shavings or commercial insulation may be used satisfactorily.

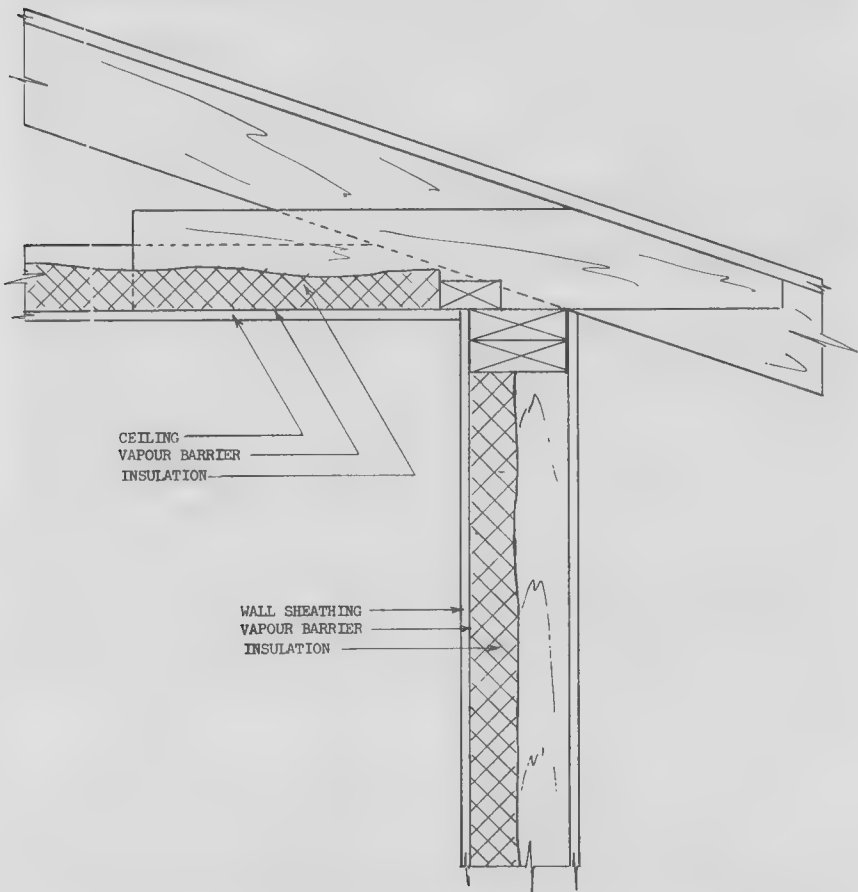


Fig. 31.—Location of insulation and vapour barriers in piggery walls and ceiling.

Vapour Barrier

A vapour barrier, preferably of plastic film, must be used to protect the insulation and structural members from moisture that migrates from inside the building. This vapour barrier must be placed between the inside sheathing and the insulation. Joints in the vapour barrier should be kept to a minimum and where these are necessary, they should be made on a framing member so that the edges are sealed together by the pressure of the sheathing against the framing member. As an added protection, louvres should be provided in the gable ends of the building to allow free air circulation over the insulation in the attic. Figure 31 shows the proper location for insulation and vapour barriers in walls and ceiling.

Heating

Hogs do not give off enough heat to maintain a desirable building temperature during severe winter weather if at the same time adequate ventilation is supplied. For this reason supplementary heat should be supplied to all except loose-housing type piggeries. Circulating heaters are most effective in distributing heat through the entire building. Heaters should be located away from the exhaust fans preferably close to farrowing pens. Heaters should be sized to provide about 50,000 btu for each 1000 square feet of floor area.

In addition to air temperature control by space heating, some radiant heat should be supplied to farrowing areas. Radiant heat may be supplied by heat lamps, suspended over the pens or by floor slabs, in which electric heating cables or hot water pipes are imbedded. Care should be taken when using either of these systems to prevent excessive temperatures. In the case of heat lamps, provision should be made to raise or lower the lamps to provide temperature control. When electric soil heating cable imbedded in concrete is used, each 400 watt cable should be imbedded to a depth of 2" in an area of at least 35 square feet. If the area served by each cable is made too small excessive floor temperatures may occur. It should also be mentioned that the heated areas should be kept well back from the sow. This helps to prevent little pigs lying close to the sow where they may be crushed.

Materials Handling Equipment

The extent to which mechanical materials handling equipment should be employed depends entirely on the individual farm. Mechanical equipment can only be justified when it represents the lowest cost method of getting work done. For example, a farmer who wishes to keep a hired hand employed during the winter so that he will be available for summer field work could not justify the same

outlay for mechanical handling equipment as the farmer who by the use of mechanical equipment is able to operate the same size of enterprise by himself.

Feeding Equipment

In cases where a saving in chore time justifies expenditures for mechanical feed distribution equipment, feed conveyors may be used. Augers or other types of conveyors can quickly move feed from a storage area to individual troughs or self-feeders. These conveyors can be arranged to fill troughs up to any desired level making manual attention at each pen unnecessary.

Feeder systems may be completely automated by coupling conveyors with metering devices which may be set to provide the desired proportions in the ration, together with automatic timers to start and stop the equipment.

Cleaning Equipment

Regular cleaning must be carried out in all but loose-housing type piggeries. Several types of mechanical cleaning methods may be employed. Conveyors laid in the manure alleys are widely used. Another principle is the use of high pressure water jets to flush the manure alleys down at regular intervals. With this system, bedding material cannot be used, so sleeping floors should be constructed of insulating concrete. A third method of mechanical cleaning is to arrange manure alleys so that a tractor mounted blade may be run through them for cleaning. As with feeding equipment, the extent to which mechanical aids to cleaning should be used depends upon the individual farm. The same criterion may be repeated: Mechanical equipment should be used if its use results in the lowest cost of production.

Sources of Information on Buildings and Equipment for Hog Raising

The following publications which may be obtained from the Alberta Department of Agriculture are recommended as more detailed sources of information:

1. "Swine Housing and Equipment", Canadian Farm Building Plan Service Bulletin.
2. Individual Floor Plans including:
 - (a) Plan No. 510 "General Purpose Hog Barn"
 - (b) Plan No. 551 "Farrowing and Feeder Hog Barn"
 - (c) Plan No. 552 "Open-front Feeder Hog Barn"
 - (d) Plan No. 553 "Feeder Hog Barn"

The bulletin "Farmstead Organization and Management" may be obtained from the Department of Extension, University of Alberta.

TABLE XXV.—GESTATION TABLE FOR BROOD SOWS (based on 112-day pregnancy period)

Date Bred	Date Due	Mar.	Date Bred	Date Due	Apr.	Date Bred	Date Due	May	Date Bred	Date Due	June	Date Bred	Date Due	July	Date Bred	Date Due	Aug.	Date Bred	Date Due	Sept.	Date Bred	Date Due	Oct.	Date Bred	Date Due	Nov.	Date Bred	Date Due	Dec.	Date Bred	Date Due
Jan. 1	23	1	21	24	1	22	25	1	23	26	1	24	27	1	25	28	1	29	31	1	22	25	1	26	29	1	21	24	1	22	25
2	24	2	22	25	2	23	26	2	24	27	2	25	28	2	26	29	2	30	1	2	23	26	2	27	30	2	22	25	2	23	26
3	25	3	23	26	3	24	27	3	25	28	3	26	29	3	27	30	3	31	1	3	24	27	3	28	31	3	23	26	3	24	27
4	26	4	24	27	4	25	28	4	26	29	4	27	30	4	28	31	4	1	2	4	25	28	4	29	1	4	24	27	4	25	28
5	27	5	25	28	5	26	29	5	27	30	5	28	31	5	29	1	5	2	3	5	26	29	5	30	2	5	25	28	5	26	29
6	28	6	26	29	6	27	30	6	28	31	6	29	1	6	30	2	6	3	4	6	27	30	6	31	3	6	26	29	6	27	30
7	29	7	27	30	7	28	31	7	29	1	7	30	2	7	31	3	7	4	5	7	28	31	7	1	4	7	27	30	7	28	31
8	30	8	28	31	8	29	1	8	30	2	8	31	3	8	1	9	8	5	6	8	29	1	8	2	5	8	28	31	8	29	1
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12	3	12	1	4	12	2	5	12	3	5	12	4	6	12	6	7	12	9	10	12	2	5	6	8	9	12	29	4	12	2	3
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15	6	15	4	7	15	5	8	15	6	8	15	7	9	15	9	10	15	12	13	15	5	8	10	11	12	15	26	7	15	5	6
16	7	16	5	8	16	6	9	16	7	9	16	8	10	16	10	11	16	13	14	16	6	9	11	12	13	16	25	8	16	6	7
17	8	17	6	9	17	7	10	17	8	10	17	9	11	17	11	12	17	14	15	17	7	10	12	13	14	17	24	9	17	7	8
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30	21	30	19	22	30	20	23	30	21	23	30	22	24	30	24	25	30	27	28	30	20	23	25	26	27	30	31	22	30	20	21
31	22	31	20	23	31	21	24	31	22	24	31	23	25	31	25	26	31	28	29	31	21	24	26	27	28	31	...	...	...	31	22

